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IDENTIFIERS	Australia

ABSTRACT

This proceedings contains 63 papers presented at ASCLITE (Annual Conference of the Australasian Society for Computers in Learning in Tertiary Education) 2001. The focus is on the following themes related to the use of computers in higher education: (1) reflection in and on action, for reflective inquiry, for students, for teachers, for design and development, for evaluation, and for organizations; (2) convergence, including approaches, modes of delivery, modes of instruction, and integration of media; (3) collaboration between students, between teachers, between students/teachers, between institutions/organizations, within institutions/organizations, in design and development, and internationalization; and (4) innovation, including creative solutions, overcoming limitations, what's new, possibilities, emerging technologies, process/product/approach, and alliances. (Contains 41 references.) (MES)

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Meeting at the Crossroads. Proceedings of the Annual Conference of the Australasian Society for Computers in Learning in Tertiary Education (ASCILITE 2001) (18th, Melbourne, Australia, December 9-12, 2001).

Edited by Gregor Kennedy, Mike Keppell, Carmel McNaught, and Tom Petrovic

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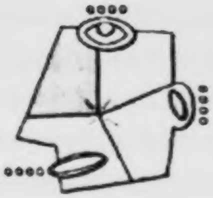

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Call for Papers

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    - Short Papers
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ASCILITE 2001 "Publication guidelines for accepted papers": Printer friendly version.

Awards

The ASCILITE awards are designed to reward leaders in the use of electronic technologies in teaching and learning in tertiary education. All current ASCILITE members may submit an example of work for consideration. Further details about the award categories and conditions are available at ASCILITE Awards.

Program Rationale

The Program Committee for ASCILITE 2001 has introduced a number of changes to the program and publication format for this year's conference. While the changes are relatively small, it is hoped they will greatly facilitate the exchange of information and ideas concerning the research, development and application of educational technologies. The major issues which need to be considered by those intending to submit a paper for the conference are outlined below.

- The ASCILITE 2001 program committee will call for full papers, short papers and workshops
- Full and short papers will be fully refereed and will be published in independent volumes of the ASCILITE 2001 conference proceedings
- Delegates will be restricted to publishing one full paper and one short paper as the first author in the conference proceedings. There is no restriction on the number of papers delegates can publish as secondary authors
- There will be three presentation formats at the conference: traditional paper presentations (25 minutes), interactive presentations (25 minutes) and poster presentations (1 hour)
- The type of paper accepted for the conference proceedings (full or short) is independent of its presentation format at the conference. Full papers will be presented as either traditional paper presentations or interactive presentations; short papers will be presented as either interactive or poster presentations

The restriction of delegates to one publication as primary author (on full and short papers) has been introduced in an attempt by the program committee to encourage diversity and variety in the conference program.

With respect to presentation format, major theoretical, technical, organisational, review, evaluation and research papers will be more suited to traditional paper presentations. However, papers that are primarily descriptions of the development and implementation of educational technology will be encouraged to demonstrate their technology, and allow delegates to experience the product or course in a hands on, interactive manner. In their submissions, authors will be asked to nominate their presentation format preference and referees will be asked to suggest the most suitable mode of presentation. The program committee will ultimately make a decision regarding the presentation format of accepted papers.

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Published Papers

Two types of papers will be published from this year's ASCILITE conference: full papers and short papers. Both full and short papers must address at least one of the conference themes: reflection, convergence, collaboration, and innovation.

Full Papers

Purpose:

The aim of full papers is to provide comprehensive and up-to-date reviews of an aspect of educational technology development and/or implementation. Full papers should clearly articulate the problem, task or area of inquiry. They should be academically rigorous and be appropriately referenced (APA style; 4th Ed.). The aim of the paper should be clear and authors should draw out the major implications or conclusions of their discussion.

Scope:

Areas that fall within the scope of full papers include:

- Major theoretical and/or conceptual reviews
- Major technical reviews and/or systems developments
- Organisational, management or policy initiatives in the area of educational technology design, development and implementation
- Empirically based evaluation and research studies including, but not restricted to, theoretically based case studies
- Large case studies of local experiences where educational technology has been fully implemented for over one year
- Major educational technology product developments
- Major pedagogical or curriculum development initiatives

Full papers are not restricted to the areas outlined above and the program committee will accept additional papers based on their academic merit and relevance to the conference themes.

ASCILITE 2001 "Publication guidelines for accepted papers": Printer friendly version.

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Short Papers

Purpose:

The aim of short papers is to provide a forum for the discussion of recent innovations in the area of educational technology development and/or implementation and a forum for the discussion of works in progress. As with full papers, short papers should be academically rigorous and appropriately referenced.

Scope:

Areas that fall within the scope of short papers include:

- Small evaluation studies, including case studies, of local experiences with educational technology
- Exploratory projects in the area of educational technology development, implementation or evaluation
- Recent educational technology product developments where the project is considered a work-in-progress

Short papers are not restricted to the areas outlined above and the program committee will accept additional papers based on their academic merit, innovation and relevance to the conference themes.

ASCILITE 2001 "Publication guidelines for accepted papers": Printer friendly version.

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Presentation Formats

Published papers can be presented in any one of three formats at the conference: traditional paper presentations, interactive presentations and poster presentations.

Traditional Paper Presentations:

Traditional paper presentations will be restricted to full paper submissions. Paper presentations are allotted a 30 minute time period in the conference program. This time is divided into 20 minutes speaking time, 5 minutes question time, and 5 minutes changeover time. Presenters may choose to use their question time to complete their presentation but must not encroach on the changeover time as this is needed to allow IT support staff to complete technical changeovers between presentations and will allow conference delegates to move between sessions.

Interactive Presentations:

Interactive presentations will be drawn from both full paper and short paper submissions. Presentations will be allotted a 25 minute time period. Presenters will be encouraged to present a brief (5 minute) overview of their paper and then demonstrate material which forms the basis of their paper (eg educational technology products, innovations, web pages, courses etc). A number of desktop computers will be available to the audience so they can explore the content of the presentation, guided by the presenter. The format of these presentations is more informal than traditional paper presentations and should encourage rolling discussion between the presenter(s) and delegates. The presentation format will also enable the audience to experience a hands on approach to the topic of the presentation.

Poster Presentations:

Poster presentations will be restricted to short paper submissions. These are traditional poster presentations which do not require a computer. A number of poster presentations will be conducted simultaneously over a one hour period. Presenters will lead informal discussions with delegates at their presentation. Presenters can bring their own laptop computers to supplement their display but computers will not be provided by the conference organisers.

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The Refereeing Process

Both full and short papers will be subjected to a double blind peer review. Full and short papers that are accepted will be published in independent volumes of the ASCILITE 2001 conference proceedings. This refereeing process will conform to DETYA standards of E1.

Please note, this year abstracts **will not** be reviewed as part of the refereeing process. Full and short papers are due by June 8 (see critical dates)

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Workshops

Purpose

As usual workshops will be run on the Sunday before the formal opening of ASCILITE 2001. Workshops make an invaluable contribution to the ASCILITE conference program as they provide a forum for detailed discussion and consideration of issues in the area of educational technology. They provide an excellent opportunity for staff development where experts in the field take time to enhance the skills and broaden the perspectives of participants.

Length:

Workshop proposals should be no longer than three A4 pages (or 1500 words). Body text should be 12 point (Times New Roman), singled-spaced and all margins should be set at 3 cm.

Workshop proposals should include the following information:

- Proposed length of workshop (half-day or full-day)
- Intended audience and degree of expertise required by workshop participants
- Clear statement of the objectives of the workshop
- A detailed description of the workshop format including activities workshop participants will be expected to engage in
- A summary of the workshop presenter's qualifications

Critical Dates

	Date
Call for papers (full, short and workshops)	Now
Papers due (full, short and workshops)	June 8, 2001
Notification of acceptance (full, short and workshops)	August 14, 2001
Proceedings file due (full and short)	September 14, 2001
ASCILITE 2001 Conference	December 9, 2001

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Submission

Submit a copy of your paper as an attachment (preferably in Word [".doc" or ".rtf" format]) to:
Gregor Kennedy
at gek@unimelb.edu.au
with ASCILITE2001 in the subject line of the email.

For further information or queries, please contact:
Gregor Kennedy, PhD
Biomedical Multimedia Unit
Faculty of Medicine, Dentistry and Health Sciences
University of Melbourne
Vic, 3010
Australia
Tel: + 61 3 8344 8937
Fax: + 61 3 8344 4998
Email:gek@unimelb.edu.au

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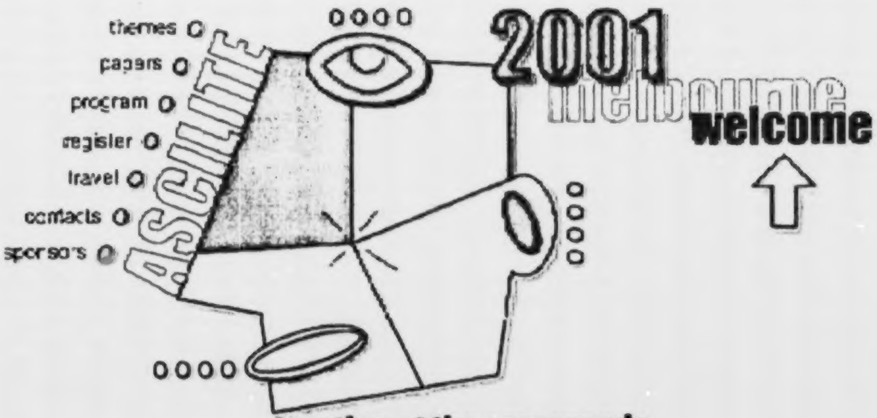
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meeting at the crossroads

- photographs
- online proceedings

December 9 to 12 The 18th Annual Conference of the Australasian Society for Computers in Learning in Tertiary Education

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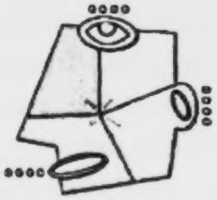

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Reflection

- In and On Action
- For Reflective Inquiry
- For Students
- For Teachers
- For Design and Development
- For Evaluation
- For Organisations

Convergence

- Approaches
- Modes of Delivery
- Modes of Instruction
- Integration of Media

Collaboration

- Between Students
- Between Teachers
- Between Students/Teachers
- Between Institutions/Organisations
- Within Institutions/Organisations
- In Design and Development
- Internationalisation

Innovation

- Creative Solutions
- Overcoming Limitations
- What's New?
- Possibilities
- Emerging Technologies Process/Product/Approach
- Alliances

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- About the Program
- Workshops (Sunday 9th December)
- Program (Sunday 9th - Wednesday 12th December)
- Keynote Speakers
- Conference Information
- Conference Dinner

- Conference Photographs

- Online Proceedings

- Print a copy of the ASCILITE 2001 brochure
- Print a copy of the ASCILITE 2001 conference information
- Print a copy of the ASCILITE 2001 program (Sunday 9th - Wednesday 12th December)

About the Program

Presentation Formats

There are a range of presentation formats at ASCILITE 2001 including: workshops, keynote addresses, traditional,short, interactive and poster presentations. We have also included two controversial issues sessions. Details about each of these presentation formats is provided below.

Workshops

Workshops will be run on the Sunday before the formal opening of ASCILITE 2001. Workshops make an invaluable contribution to the ASCILITE conference program as they provide a forum for detailed discussion and consideration of issues in the area of educational technology. They provide an excellent opportunity for staff development where experts in the field take time to enhance the skills and broaden the perspectives of participants.

Traditional Presentations

Traditional paper presentations are allotted a 30 minute time period in the conference program. This time is divided into 20 minutes speaking time, 5 minutes question time, and 5 minutes changeover time. Presenters may choose to use their question time to complete their presentation but must not encroach on the changeover time as this is needed to allow IT support staff to complete technical changeovers between presentations and will allow conference delegates to move between sessions. There are 57 traditional presentations throughout the program.

Short Presentations

Short paper presentations are allotted a 20 minute time period in the conference program. This time is divided into 10 minutes speaking time, 5 minutes question time, and 5 minutes changeover time. Presenters may choose to use their question time to complete their presentation but must not encroach on the changeover time as this is needed to allow IT support staff to complete technical changeovers between presentations and will allow conference delegates to move between sessions. Twelve short presentations in four parallel sessions will be held on Monday afternoon between 4:00 and 5:00 pm.

Interactive Presentations

Interactive presentations are allotted a 30 minute time period. Presenters will present a brief (10 minute) overview of their paper and then demonstrate material (15 minutes) which forms the basis of their paper (e.g. educational technology products, innovations, online courseware, etc.) leaving 5 minutes changeover time. A number of desktop computers will be available to the audience so they can explore the content of the presentation, guided by the presenter. The format of these presentations is more informal than traditional paper presentations and should encourage rolling discussion between the presenter(s) and delegates. The presentation format will also enable the audience to experience a hands-on approach to the topic of the presentation. There are 17 interactive sessions in the program. Interactive sessions are held in the Biomedical Multimedia Unit Lab 2 on Monday and in the Percy Baxter Room (Level 1 Baillieu Library) on Tuesday and Wednesday.

Poster Presentations

Nineteen poster presentations will be conducted in the Copland Lecture Theatre Foyer over a one hour period on Tuesday afternoon. Presenters are encouraged to put their posters up on Tuesday morning so delegates can review them over the day. Between 4:00 and 5:00 pm on Tuesday, presenters will lead informal discussions with delegates at the site of their poster.

Controversial Issues

Two controversial issues sessions will be held in the Copland Theatre as the final sessions on Monday and Tuesday. The sessions are run as mini-debates with each speaker being given 5 minutes to address the topic (positive and negative in turn) before the issue is put to the floor for a general debate among delegates. Make sure you are there to have your say! Details of the topics and speakers are provided below.

TOPIC 1 (Monday): *Widespread and growing interest in online, web-based*

learning has killed a commitment to high quality interactive multimedia.
Moderator: Cathy Gunn
Positive (For): Carmel McNaught & John Hedberg
Negative (Against): Shirley Alexander & Rod Sims

TOPIC 2 (Tuesday): *There is no effective way to assess online collaboration.*
Moderator: Carmel McNaught
Positive (For): Ron Oliver & Catherine McLoughlin
Negative (Against): John Bain & Rob Phillips

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To join ASCILITE please visit http://www.ascilite.org.au/

For further information about ASCILITE membership please contact:

ASCILITE Secretariat
CEDIR
University of Wollongong
NSW Australia 2522

Phone: 02 4221 4895 (International +612 4221 4895)
Fax: 02 4225 8312 (International +612 4225 8312)
Email: info@ascilite.org.au

PLEASE NOTE:
Registration at the ASCILITE 2001 Conference does not include ASCILITE Membership

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The following information provides details about conference registration for ASCILITE 2001.

Types of Registration

Early Bird Registrations will be accepted until 08th October 2001

Full Registration Includes:

- Three days of conference sessions
- Morning tea, lunch and afternoon tea on Monday, Tuesday and Wednesday
- One ticket to the Welcome Reception on Sunday December 9th
- One ticket to the Conference Dinner on Tuesday December 11th
- A delegate satchel including a program booklet and conference proceedings.

Day Registration Includes:

- Conference sessions for the day registered
- Morning tea, lunch and afternoon tea for the day registered
- A delegate satchel including a program booklet and conference proceedings.

Student Registration Includes:

- Three days of conference sessions
- Morning tea, lunch and afternoon tea on Monday, Tuesday and Wednesday
- A delegate satchel including a program booklet.

Workshop Only Registration Includes:

- The workshop selection(s) chosen
- Lunch and tea breaks for the half day/full day workshops
- Any workshop materials provided by the workshop facilitator.

Registration Rates (Inclusive of GST)

Full Registration (after 30th September)

Member	$575
Non-Member	$675
Student	$300
Day (Mon, Tues or Wed)	$275

Conference Workshops

5 hour	$170
2.5 hours	$90

Optional Extras

One ticket to the Welcome Reception, one ticket to the Conference Dinner and a copy of the conference proceedings are included with full registration.

The Welcome Reception takes place between 6:00pm to 8:00pm on Sunday December 9th. Extra tickets for the Welcome Function cost $30; this includes drinks and finger food.

The Conference Dinner takes place in the evening of Tuesday December 11th. The theme for the dinner dance is the Roaring 20s and Swingin' 30s. See http://www.medfac.unimelb.edu.au/ascilite2001/dinner/index.html for further details.
Extra Tickets to the Conference Dinner cost $80; this includes drinks, a three course meal and entertainment.

Extra copies of Conference Proceedings are available for $80 and can be purchased at the conference.

How to Register

Registration for ASCILITE 2001 is being handled by "Meetings First".

1. To register you will first need to contact Meetings First to obtain a security PIN number (if you have not received one already). Meetings First can be contacted by
    - Email: ascilite@meetingsfirst.com.au
    - Phone: +61 3 9853 5538
3. Once you have your PIN number go to the online registration form at: http://www.meetingsfirst.com.au/fsite/site/registration.asp
4. Just select "ASCILITE 2001" from the drop down menu, enter your first name, last name and PIN, press submit and follow the prompts until you get a "Thank you" message. Please note that you will need to complete ALL FIELD ENTRIES to progress through the registration form.
5. Please note, during this process, you may pay by credit card (using the National Australia Bank secure website) or if you prefer, please tick the "I'll send a cheque" box.

Confirmation of Registration

Your registration will be acknowledged in writing with confirmation of your choices along with your official receipt (tax invoice).

Cancellation Policy

Cancellation of registration must be in writing. Cancellations received before 1st December 2001 will be eligible for a full refund minus a $100 administration charge.

PLEASE NOTE: NO REFUND WILL BE GIVEN AFTER 1ST DECEMBER 2001, however, substitutions are allowed.

Further Information

For more information please contact:
Meetings First
3 Peel Street
KEW Victoria 3101
Email: ascilite@meetingsfirst.com.au
Phone: +61 3 9853 5538
Fax: +61 3 9853 1806

More information regarding The University of Melbourne, travel to Melbourne, getting around town, accommodation and tourism are available under the travel section.

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We have put together a list of resources to help you plan your travel.

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- The University of Melbourne
- Travel to Melbourne
- Getting around town
- Accommodation
- Tourism

The University of Melbourne

Melbourne Uni

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Melbourne Uni

- Where are we?
- Map of the Parkville campus

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Travel to Melbourne

Flight info

- **QANTAS** has been appointed official airline for this meeting. Special conference discount rates (up to 55% off economy fares and up to 10% off business class fares) are available by booking directly through Qantas on 1800 684 880. If you elect to take advantage of these fares:
    - you must mention the Association Profile Number (2976428)
    - tickets can be purchased up to the day of departure
    - date changes are permitted at any time, subject to class availability
    - tickets are fully refundable up to 3 days prior to the departure of your first flight
    - you may travel up to 7 days either side of the meeting date
- Ansett Australia
- Virgin Blue

Transfers

- Taxi about $40.00 from Melbourne airport to CBD (30 min)
- Skybus about $12.00 one-way. Skybus departs from Melbourne airport every 30 minutes from 6.40am to 11.40pm. The bus travels directly to 58 Franklin Street in the CBD

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Getting around town

Near the CBD you can get around on public transport or by taxi.

Public transport

- Trams, Trains, Buses
- Rail map

Taxi

- $1.10 phone booking fee, $2.80 flagfall and $1.30 per km
- Arrow - Tel: 13 22 11
- Black Cabs - Tel: 13 22 27
- Embassy - Tel: 13 17 55
- Silvertop - Tel:13 10 08
- Others

Car Rental

- Avis
- Hertz
- Thrifty
- Others

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Accommodation

Special conference rates have been negotiated at hotels located within easy walking distance of the University and with convenient access to public transport. ***To access these rates, you must book when registering to attend the conference via the Meetings First registration page***

Please note registrations for this meeting are being collected electronically. During this process, you may pay by credit card (using the National Australia Bank secure website) or if you prefer, please tick the "I'll send a cheque" box.

Accommodation is subject to availability if bookings are received after October 26. One night's accommodation must be pre-paid for the hotels and all accommodation must be pre-paid for University College. Refunds are at the discretion of the hotels.

The Chifley on Flemington

Near the corner of Elizabeth Street and Flemington Road, less than 10 minutes walk to the University. The Chifley rooms are furnished to provide a high level of comfort and incorporate working areas. Check in time is 2.00 pm and check out time is 11am.

- $136 single/double/twin per day
- add $16 pp per day for a bed and breakfast rate (breakfast is normally $21)

Phone: +61 3 9329 9344
Toll free: 1800 056 064
Fax: + 61 3 9328 4870
WWW:http://www.chifley.citysearch.com.au

Elizabeth Tower Hotel

On the corner of Elizabeth and Grattan Streets, only a few minutes walk from the University. Standard rooms are modestly appointed, but are air conditioned with tea and coffee making facilities, executive rooms are of a higher standard. Triple rooms have one double bed and one single bed. Check in time is 1.00 pm and check out time is 10.00 am.

- $105 single, double, twin or triple per day
- add $20 pp per day for more than three people

Phone: +61 3 9347 9211
Toll free: 1800 804 202
Fax: + 61 3 9347 0396
WWW:http://www.elizabethtower.com.au/

Rydges - Carlton

Located at 701 Swanston St Carlton, just around the corner from the University. Check in time is 2 pm and check out time is 10am.

- $130 room only (single/double/twin)
- $142 per night with full buffet breakfast for one
- $153 per night with full buffet breakfast for two

Phone: +61 3 9347 7811
Toll free: 1800 333 001
Fax: + 61 3 9347 8225
WWW:http://www.rydges.com/carlton
Email: reservations_carlton@rydges.com

University College

Located in College Crescent, Parkville, just north of the University. This on-campus student accommodation is largely single rooms (single bed) with shared, unisex bathrooms. There are 12 en-suite rooms with a double bed. (Sorry, all booked out.) In addition, free parking will be available for all conference delegates.

You may arrive any time until 6.00 pm. If you arrive after that, special arrangements will need to be made so please contact Meetings First if you will be arriving after 6.00 pm. Check out time is 10am.

- $39.60 per night, bed and breakfast, single only in standard room
- $59.40 per night bed and breakfast, single in an en-suite room
- $92.40 per night bed and breakfast, double in an en-suite room

Phone: +61 3 9347 3533

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Tourism

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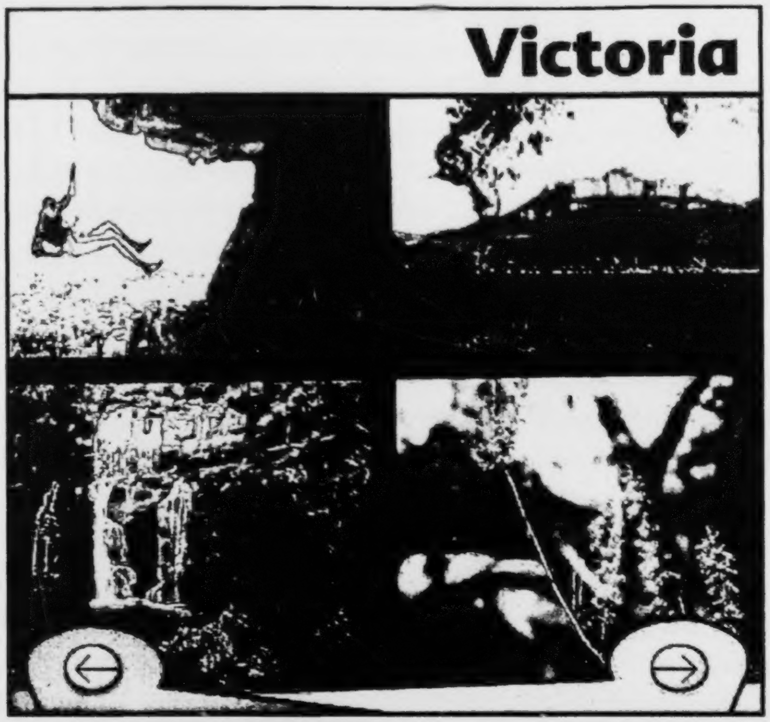

General

- Victoria Tourism
- City Search
- City of Melbourne, visitor information
- The essentials about Melbourne.
- Melbourne Virtual Tour
- Lonely Planet - Melbourne
- Melbourne webcam

Food

- Melbourne Diners Guide
- Lygon Street. Close to the University, sometimes dubbed "little Italy", home to many fine restaurants.

Attractions

- CBD map, tram routes and attractions
- Great Ocean Road
- Melbourne Aquarium
- Museum Victoria
    - Melbourne Museum
    - Scienceworks
    - Immigration Museum
- National Gallery of Victoria
- Royal Botanic Gardens

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- Victorian Parks
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Fax: +613 8344 0188
Email: Julie Filarski

ASCILITE

The Australasian Society for Computers in Learning in Tertiary Education. Please visit the ASCILITE web site for full details of the organisation.

ASCILITE 2001 Organising Committee

- Mike Keppell
- Gregor Kennedy
- Tom Petrovic
- Koren Mitchell
- Carmel McNaught
- Peter Harris
- Matthew Riddle
- Som Naidu

ASCILITE 2001 - List of Referees

- Shirley Alexander, University of Technology, Sydney
- Trish Andrews, University of Queensland
- John Bain, Griffith University
- Carol Bowie, Griffith University
- Helen Carter, University of Wollongong
- Bob Corderoy, University of Wollongong
- Gilles Doiron, National University of Singapore
- Ainslie Ellis, Monash University
- Allan Ellis, Southern Cross University
- Mike Fardon, University of Western Australia
- Brian Ferry, University of Wollongong
- Mark Freeman, University of Technology, Sydney
- Paul Fritze, University of Melbourne
- Tony Gilding, Monash University
- Jennifer Goddard, LaTrobe University
- Kathleen Gray, RMIT University
- Cathy Gunn, University of Auckland
- Barry Harper, University of Wollongong
- John Hedberg, University of Wollongong
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- Jan Herrington, Edith Cowan University
- Alan Holzl, University of Queensland
- Gordon Joughin, Griffith University
- Terry Judd, University of Melbourne
- Bob Kemm, University of Melbourne
- David Kennedy, Monash University
- Gregor Kennedy, University of Melbourne
- Mike Keppell, University of Melbourne
- Geraldine Lefoe, University of Wollongong
- Peter Ling, Swinburne University of Technology
- Kathy Lynch, Monash University
- Jon Mason, University of Melbourne
- Catherine McLoughlin, University of New England
- Carmel McNaught, RMIT University
- John Milton, RMIT University
- Koren Mitchell, University of Melbourne
- Michael Morgan, Southern Cross University
- Som Naidu, University of Melbourne
- Ron Oliver, Edith Cowan University
- Meg O'Reilly, Southern Cross University
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- Russ Pennell, University of Western Sydney
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- Gregor Kennedy
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Workshops

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Sunday 9 December, 2001.

8.00	Registration - Foyer Economics and Commerce Building			
9:00	BMU Lab 1	Doug McDonell Lab	Commerce 1	BMU Lab 2
	Implementing collaborative learning environment workshops Paul Fritze, Helen Kavnoudias, Robert Kemm, Neil Williams The University of Melbourne	External peer-review of the quality of learning objects Peter Taylor, Craig Zimitat & Brad Young Griffith University	Instructional design for distance education: What's different? Doreen Gosmire & Karen Norum University of South Dakota	WebQuests: An inquiry based instructional strategy using the internet Maureen Brown Yoder Lesley University
11:30	Morning Tea/Lunch - Foyer and Courtyard Economics and Commerce Building			
12:00	BMU Lab 2	BMU Lab 1	Commerce 1	Doug McDonell Lab
	interActive learning online...or...how to relate to your students when you can't see their faces Meg O'Reilly Southern Cross University	Creating and using web-based simulations in educational and organizational environments (I) Albert Ip & Roni Linser Digital Learning Systems P/L & Ausis P/L	Assessing student learning: Expanding assessment to include a focus on process as well as content outcomes Alex Radloff RMIT University Barbara de la Harpe Curtin University of Technology	Engaged learning: Using concrete simulations to teach about an online world Michael O'Brien The University of Melbourne
2:30	Lunch/Afternoon Tea - Foyer and Courtyard Economics and Commerce Building			
3:00	BMU Lab 2	BMU Lab 1	Commerce 1	Doug McDonell Lab

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	A student immersion into a technologically assisted learning experience: the fitness, health and wellness GIG Bob Boyd & Halima Goss Queensland University of Technology	Creating and using web-based simulations in educational and organizational environments (II) Albert Ip & Roni Linser Digital Learning Systems P/L & Ausis P/L	Assessment and online learning Rod Sims Deakin University Meg O'Reilly Southern Cross University	Developing 3D virtual learning environments Barney Dalgarno Charles Sturt University
5:30	End of Program Day 1			
6:00	Welcome Drinks - Courtyard Economics and Commerce Building			

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Workshops
Sunday 9 December, 2001.

8.00	Registration - Foyer Economics and Commerce Building			
9:00	BMU Lab 1	Doug McDonell Lab	Commerce 1	BMU Lab 2
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	A student immersion into a technologically assisted learning experience: the fitness, health and wellness GIG Bob Boyd & Halima Goss Queensland University of Technology	Creating and using web-based simulations in educational and organizational environments (II) Albert Ip & Roni Linser Digital Learning Systems P/L & Ausis P/L	Assessment and online learning Rod Sims Deakin University Meg O'Reilly Southern Cross University	Developing 3D virtual learning environments Barney Dalgarno Charles Sturt University
5:30	End of Program Day 1			
6:00	Welcome Drinks - Courtyard Economics and Commerce Building			

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Monday 10 December, 2001.

	Copland	Commerce 1	Commerce 2	Commerce 3	BMU Lab 2
8.00	Registration - Foyer Economics and Commerce Building				
8.45	Welcome and Opening - Copland Theatre Professor Alan Gilbert Vice-Chancellor The University of Melbourne				
9.00	Keynote Speaker Lloyd Rieber Designing learning environments that excite serious play [p. 1]				
10.00	Morning Tea - Foyer and Courtyard Economics and Commerce Building				
10:30	Chair: Som Naidu	Chair: Tony Gilding	Chair: Rob Phillips	Chair: Cathy Gunn	Chair: Kris Elliott
	Rod Sims, Graeme Dobbs & Tim Hand Proactive evaluation: New perspectives for ensuring quality in online learning applications [p. 509]	Juhani Tuovinen Finnish virtual (online) collaborative university - A model for Australia? [p. 529]	Meg O'Reilly & Diane Newton Interaction online: Above and beyond requirements of assessment [p. 461]	Geraldine Lefoe, Cathy Gunn & John Hedberg Recommendations for teaching in a distributed learning environment: The students' perspective [p. 355]	Iain McAlpine & Nick Dudley Teaching soils online using a problem-based learning design [p. 387]

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11:00	Colin Baskin Using Kirkpatrick's four level-evaluation model to explore the effectiveness of collaborative online group work [p. 37]	Luke Behncke & Carmel McNaught Seeing the bigger picture: Experiences of employing online learning within TAFE at RMIT [p. 55]	Ainslie Ellis Student-centred collaborative learning via face-to-face and asynchronous online communication: What's the difference? [p. 169]	Robert McLaughlan, Denise Kirkpatrick, Holger Maier & Philip Hirsch Academic and institutional issues related to the planning and implementation of a multidisciplinary roleplay simulation involving collaboration across institutions [p. 407]	Giselle Kett, Rosemary Clerehan & Renee Gedge An online writing support initiative for first-year information technology students [p. 345]

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Monday 10 December, 2001.

	Copland	Commerce 1	Commerce 2	Commerce 3	BMU Lab 2
11:30	Catherine McLoughlin & Joe Luca Quality in online delivery: What does it mean for assessment in e-learning environments? [p. 417]	John Kenny Where academia meets management: A model for the effective development of quality learning materials using new technologies [p. 327]	Len Bird Virtual learning in the workplace: The power of 'communities of practice' [p. 93]	Iris Vardi & Alison Bunker The relationship between the perceived value of supplementary online components, and student roles and responsibilities [p. 549]	Jackie Halliday The graduate diploma in education technology: The development of an online programme [p. 245]

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12:00	David Kennedy, Len Webster, Robyn Benson, Di James & Nathan Bailey The Monash portal: More than just a virtual gateway [p. 317]	Dale Holt, Mary Rice, Ian Smissen & Judy Bowly Towards institution-wide online teaching and learning systems: Trends, drivers and issues [p. 271]	Elizabeth Stacey & Wendy Fountain Student and supervisor perspectives in a computer-mediated research relationship [p. 519]	Robyn Benson, Les Hardy & Jodie Maxfield The international classroom: Using reflective practice to improve teaching and learning [p. 83]	Susan Shannon, Ian Roberts & Robert Woodbury vGallery scaffolding reflection in action for students and teachers [sp. 141]
12:30	Lunch - Foyer and Courtyard Economics and Commerce Building				
1.30	Chair: Helen Carter	Chair: Shirley Alexander	Chair: Gerry Lefoe	Chair: Ainslie Ellis	Chair: Matthew Riddle
	Mary Peat, Sue Franklin, Alison Lewis & Rod Sims Staff and student views of the usefulness of information technology materials within an integrated curriculum: Are these educational resources effective in promoting student learning? [p. 471]	Robert Ellis Reflecting on quality learning in a student writing experience supported by technology [p. 179]	Maureen Bell A case study of an online role play for academic staff [p. 63]	Richard Caladine Learning environments of the future: Narrow to broadband via DVD [p. 117]	Adrian Egan, Jayaratnam Tharmaraj & David Hirst Comparative nutrition from principles to practical feeding systems [sp. 41]

2.00	Ingrid Scholten The influence of supplementary multimedia instruction on students' knowledge of normal swallowing: An authentic investigation over time [p. 499]	Alison Bunker & Iris Vardi Why use the online environment with face-toface students? Insights from early adopters [p. 111]	Kathleen Gray & Carmel McNaught Evaluation of achievements from collaboration in a learning technology mentoring program [p. 217]		Caroline Ingram & Dave Peacock Recent developments for a distributed national electronic resource for learning and teaching in the UK [sp. 73]

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	Copland	Commerce 1	Commerce 2	Commerce 3	BMU Lab 2
2.30	Joe Luca & Pina Tarricone Does emotional intelligence affect successful teamwork? [p. 367]	John Cook, Carole Leathwood & Peter Oriogun Monitoring gender participation and promoting critical debate in an online conference [p. 141]	Sandra Jones Collaboration - A threat to academic autonomy? [p. 299]		Allison Brown & Diana Drinkwater Encouraging active learning with more interactive WWW designs [sp. 13]

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3.00	Anthony Gilding & John Martino Learning about online learning in a dual sector university: Reflections, issues and challenges [p. 207]	Shironica Karunanayaka, Brian Ferry & John Hedberg Developing internet-based study materials as novice web-designers: Experiences of twelve Sri Lankan teacher educators [p. 307]	Francesca Collins, Julianne Lynch & Selby Markham The mini-conference as a research tool: Encouraging collegiality among ICT educators [p. 133]		Howard Grossman & Virginia Grossman Development of a multimedia program that crosses traditional discipline boundaries [sp. 69]
3.30	Afternoon Tea - Foyer and Courtyard Economics and Commerce Building				
4.00	Short Paper Presentations				
	Chair: Craig Zimitat	Chair: Rod Sims	Chair: Alison Young	Chair: David Kennedy	
	Mary Peat, Sue Franklin & Alison Lewis A review of the use of online self-assessment modules to enhance student learning outcomes: Are they worth the effort of production? [sp. 137]	Christopher Morgan Seeking perseverance through closer relations with remote students [sp. 125]	Dianne Chambers Problem-based learning & IT to support authentic tasks in teacher education [sp. 25]	Jules Moloney 3D game software and architectural education [sp. 121]	
4.20	Sue Franklin, Mary Peat & Alison Lewis Virtual versus traditional dissections in enhancing learning: A student perspective [sp. 61]	Elizabeth Creese From dependency towards self direction via virtual chat: The case of one TAFE class [sp. 29]	Catherine McLoughlin & Rowan Hollingworth The weakest link: Is web-based learning capable of supporting problem solving and metacognition?	Raymond Lister & Peter Jerram Minimal mark-up of multiple choice exams using XML [sp. 101]	

			[sp. 117]		
4.40	Kathy Lynch & Gregor Kennedy Are they using IT how we thought they would? An evaluation of students' learning processes [sp. 105]	Som Naidu & David Cunnington Showcasing the experience of practitioners with technology-enhanced teaching and learning [sp. 129]	Mary Wlodek, Helen Kavnoudias, Gregor Kennedy, Jennifer Kirk, Terry Judd & Mike Keppell A woman's reproductive life cycle: A developmental journey [sp. 161]	Kristine Elliott, Gary Anderson, Lou Irving & Andrew Bonollo Expanding the user base of computer facilitated learning resources [sp. 145]	
5.00	Controversial Issue #1 - Copland Theatre Widespread and growing interest in online, web-based learning has killed a commitment to high quality interactive multimedia Moderator: Cathy Gunn Positive (For): Carmel McNaught & John Hedberg Negative (Against): Shirley Alexander & Rod Sims				
6.00	End of Program Day 2				
6.10	ASCILITE AGM - Commerce 1				
	Restaurant Night				

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Tuesday 11 December, 2001.

	Copland	Commerce 1	Commerce 2	Commerce 3	Percy Baxter
8.00	Registration - Foyer Economics and Commerce Building				
9.00	Keynote Speaker Alex Radloff Getting online: The challenges for academic staff and institutional leaders [p. 11]				
10.00	Chair: John Bain	Chair: Andy Williamson	Chair: Richard Elliott		Chair: Mike Fardon

	Rob Phillips *Special Presentation* Learning-centred evaluation - The story of the ASCILITE CUTSD evaluation project	Rebecca Albury On being 'Head' - Reflections on leading an educational innovation involving computer technology [p. 23]	Sue Bennett, Barry Harper & John Hedberg Designing real-life cases to support authentic design activities [p. 73]		Deborah Ingram, Eileen Thompson & MoonJoong Tcha The convergence of text and graphics in an online learning environment: A case study in economics [p. 281]
10:30	Mike Keppell, Michael Arnold, Marilys Guillemin, Elizabeth Deveny, Teng Liaw, Chris Pearce, Dianne Mulcahy & Matthew Riddle A collaborative interdisciplinary approach to the evaluation of the Clinicians Health Channel [p. 335]	Geoff Cumming Project design and achieving educational change: From StatPlay to ESCI [p. 151]	Shirley Reushle & Jacquelin McDonald A comparative study of software to aid the development of a conceptual framework for instructional design theory [p. 491]		Rosemary Clerehan, Tim Moore & Sheila Vance Collaborating in the transition to tertiary writing [p. 125]
11:00	Morning Tea - Foyer and Courtyard Economics and Commerce Building				
11:30	Chair: Elizabeth Creese	Chair: Elizabeth Stacey	Chair: Allan Christie		Chair: Kim McShane
	Steve Draper, Julie Cargill & Quintin Cutts Electronically enhanced classroom interaction [p. 161]	Bill Bates & Jerome Leary Supporting a range of learning styles using a taxonomy-based design framework approach [p. 45]	Mark Northover & Claire Donald The development of online learning at UNITEC - Same environment, new landscape? [p. 443]		Tim van Gelder How to improve critical thinking using educational technology [p. 539]

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Tuesday 11 December, 2001.

	Copland	Commerce 1	Commerce 2	Commerce 3	Percy Baxter
12:00	Andy Williamson, Carolyn Nodder & Patrick Baker A critique of educational technology research in New Zealand since 1996 [p. 567]	Ray Webster Interfaces for e-learning: Cognitive styles and software agents for web-based learning support [p. 559]	Ray Wyatt Web-based teaching: The beginning of the end for universities? [p. 575]		Mark McCrohon, Victor Lo, Jim Dang & Carol Johnston Video streaming of lectures via the internet: An experience [p. 397]
12:30	Lunch - Foyer and Courtyard Economics and Commerce Building				
1:30	Apple Special Sponsor Presentation - Copland Theatre				
	Chair: Tom Petrovic	Chair: Deborah Ingram	Chair: Judy Lyons		Chair: Terry Judd
2:00	Carmel McNaught Quality assurance for online courses: From policy to process to improvement? [p. 435]	Tom Boyle & John Cook Towards a pedagogically sound basis for learning object portability and reuse [p. 101]	Paul Gruba Developing staff IT skills in the Arts [p. 225]		Julie Willis, David Hirst & Gordon Yau The architectural history web-source: Learning through composition and role-play [sp. 157]
2:30	Anthony Herrington, Jan Herrington, Ron Oliver, Sue Stoney & Jackie Willis The development of an instrument to audit online units [p. 263]	Albert Ip & Iain Morrison Learning objects in different pedagogical paradigms [p. 289]	Maureen Farrell & Ian McGrath Online learning in an undergraduate nursing program: The perceptions of the learning technology mentors		Peter Maclaren & David Seedhouse Computer-mediated communication with integrated graphical tools used for health care decision-making

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			[p. 197]		[sp. 109]
3:00	Cathy Gunn Effective online teaching - How far do the frameworks go? [p. 235]	Jill Evans, Grainne Conole & Karla Youngs FILTER: Focusing images for learning and teaching - An enriched resource [p. 189]	Julianne Lynch & Francesca Collins Academics' concerns about "the push for flexible delivery" [p. 377]		Craig Zimitat & Lynette Stockhausen A web tool (TICTT) to support reasoning in the health professions [sp. 165]
3:30	Afternoon Tea - Foyer and Courtyard Economics and Commerce Building				

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Tuesday 11 December, 2001.

4.00	Poster Presentations - Copland Theatre Foyer (Lower)	
	Alan Boykiw & Allison Brown Creating authentic technology environments for immersive learning [sp. 1]	Jan Brace-Govan, Sandra Luxton & Peter Wagstaff 'Orientation module' to increase ease of access to online discussion forum for postgraduate students [sp. 5]
	Christopher Briggs, Norm Eizenberg, Priscilla Barker & Ivica Grkovic An@tomedia. A new approach to medical education developments in anatomy [sp. 9]	Bruce Carter & Virendra Mistry Enduring change: Technological management in education [sp. 21]
	Barney Dalgarno & John Hedberg 3D learning environments in tertiary education [sp. 33]	Hagare Dharmappa, Robert Corderoy & Prasanthi Hagare Supporting learning in environmental engineering: Interactive water treatment processes [sp. 37]

	Jill Evans The Bristol BioMed learning and teaching project: Promoting effective use of images in biomedicine [sp. 49]	Wendy Fountain & Sheona Thomson Backyard wisdom and student insights in developing effective web supported learning [sp. 57]
	Paul Fritze An institutional system for developing flexible online learning and teaching environments [sp. 65]	Glenda Jacobs Opportunities lost: Resistance to collaboration in the New Zealand K-12 teaching community [sp. 77]
	Daniel Johnson, Peter Sutton & Neil Harris Extreme programming requires extremely effective communication: Teaching effective communication skills to students in an IT degree [sp. 81]	Lesley Jolly Riverbend @ WebCT: Innovative reuse of existing technological resources for problem-based learning in professional education [sp. 85]
	Terry Judd Navigation systems, architects and engineers [sp. 89]	Jennifer Kirk & Gregor Kennedy Adding value to educational multimedia: The role of graphic design [sp. 93]
	David Lewis & Timothy Shea Bringing virtual team skills to undergraduate business schools' students through cross-campus collaboration [sp. 97]	Linda Marshall, Maria Northcote & Max Lenoy Design influences in the creation of an online mathematics unit for indigenous adults [sp. 113]
	Michael O'Brien & Dianne Chambers Engaged learning: Using concrete simulations to teach about an online world [sp. 133]	Phillipa Sturgess A "Trojan Horse" approach to teaching about online design [sp. 145]
	Ayshe Talay-Ongan, Trish Edmonds & Maree Gosper Information literacy for students in early childhood [sp. 153]	
5:00	Controversial Issue #2 - Copland Theatre There is no effective way to assess online collaboration Moderator: Carmel McNaught Positive (For): Ron Oliver & Catherine McLoughlin Negative (Against): John Bain & Rob Phillips	
6.00	End of Program Day 3	
7.30	Conference Dinner Dance - The Roaring 20s & Swingin' 30s - San Remo Ball Room	

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Wednesday 12 December, 2001.

	Copland	Commerce 1	Commerce 2	Commerce 3	Percy Baxter
8.00	Registration - Foyer Economics and Commerce Building				
9.00	Keynote Speaker Tim Koschmann Revisiting the paradigms of instructional technology [p. 15]				
10:00	Chair: Kathleen Gray	Chair: Mary Rice	Chair: Carmel McNaught		Chair: Russ Pennell
	Ron Oliver Learning objects: Supporting flexible delivery of online learning [p. 453]	Mark McMahon & Joe Luca Assessing students' self regulatory skills [p. 427]	Uschi Felix Students as informants for web-based learning design [sp. 53]		Sam Bucolo, John Hayes & Halima Goss Developing a web-based methodology to teach a web-based technology - The e-journal approach [sp. 17]
10:30	Barry Harper, Ron Oliver & Shirley Agostinho Developing generic tools for use in flexible learning: A preliminary progress report [p. 253]	Renata Phelps, Allan Ellis & Stewart Hase The role of metacognitive and reflective learning processes in developing capable computer users [p. 481]	Chair: Liz Gurrie Peter Vitartas, Keith Sloan, Philip Poh & Marinka Dunlop *Special Presentation* An assessment of crosscultural and social network influences on the delivery of an international teaching model utilising a		Geoff Swan Encouraging students to interact with angular quantities [sp. 149]

			computer-mediated approach [sp. 169]		
11:00	Morning Tea - Foyer and Courtyard Economics and Commerce Building				
11:30	SmartForce Special Sponsor Presentation- Copland Theatre				
12:00	NextEd Special Sponsor Presentation - Copland Theatre				
12:30	ASCILITE Awards/ASCILITE 2002 Launch - Copland Theatre				
1:30	Lunch - Foyer and Courtyard Economics and Commerce Building				
2:30	Close of Conference				

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Keynote Speakers

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Professor Lloyd Rieber

Department of Instructional Technology,
The University of Georgia

Lloyd is interested in visualization, cognitive psychology and constructivistic orientations to instructional design. His research focuses on using computer animation in the design of interactive learning environments. His most recent research is about the integration of computer-based microworlds, simulations and games using play theory as the theoretical framework. He is now applying this research to online learning environments. He has written two books. The first, Computers, Graphics, and Learning, was the recipient of Association for Educational Communications and Technology's James W. Brown Publication Award. He was also one of the originators of ITFORUM, a professional listserv devoted to instructional technology issues, and was its first moderator. He is chair-elect of the Special Interest Group for Instructional Technology of the American Educational Research Association and is also a past-president of the Association for the Development of Computer-Based Instructional Systems (ADCIS).

WWW: http://it.coe.uga.edu/~lrieber and http://www.NowhereRoad.com

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Professor Alex Radloff

Associate Dean (Academic)
Director of Teaching Quality in the Faculty of Life Sciences,
RMIT University

Alex's research interests include self-regulation of learning in university students, the development of student academic writing skills and professional development of academic staff. She has been the recipient of a CAUT and a CUTSD teaching development grant for her work on student writing and is the co-author of three books on student writing and learning. Alex has been a member of the HERDSA National Executive for six years and is a past President of the HERDSA WA Branch. Alex is an experienced presenter and workshop facilitator and in the past five years has conducted more than 40 consultancies, training programs, seminars and evaluation studies for various bodies in the public and private sectors in Australia. She has also designed and presented professional development programs for participants from the Philippines, Indonesia, Malaysia, Pakistan and South Africa.

Associate Professor Tim Koschmann

Department of Medical Education,
Southern Illinois University

Tim undertakes research on interaction in settings of collaboration and learning. Much of his work has concentrated on problem-based learning (PBL) as a form of educational innovation. He has been active in the emerging field of Computer Support for Collaborative Learning (CSCL). He was Program Chair for the first international conference on CSCL (CSCL '95) at Indiana University and Conference Co-Chair for CSCL '97 at the University of Toronto. Tim was the editor of CSCL: Theory and Practice of an Emerging Paradigm (Lawrence Erlbaum Associates, 1996) and is co-editor (together with Naomi Miyake and Rogers Hall) of a sequel scheduled to appear later this year. He is an associate editor for the Journal of the Learning Sciences and is on the editorial board of several other scholarly journals, including the American Educational Research Journal, Distance Education, and the Journal of Interactive Media in Education.

WWW: http://edaff.siumed.edu/tk/

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Conference Information

The following guidelines are designed to assist you at the conference and while you are staying in Melbourne. If you have any questions or require assistance please do not hesitate to ask at the conference registration desk in the foyer of the Economics and Commerce Building.

Conference Registration and Help Desk

The registration and help desk is located in the foyer of the Economics and Commerce Building and is staffed by Meetings First personnel.

It will be open at the following times:

Sunday 9 December:	0800 - 2000
Monday 10 December:	0800 - 1800
Tuesday 11 December:	0800 - 1800
Wednesday 12 December:	0800 - 1500

Messages

Messages can be left for delegates during the conference by calling the Conference Secretariat on **+61 3 9853 5538**. Please check the noticeboard near the registration desk for messages.

Parking

Car parking is available at University College, (College Crescent, Parkville) at no charge.

Conference Venues

All sessions for the conference will be held at the University of Melbourne. Most sessions and activities will be held in and around the Economics and Commerce Building. The labs of the Biomedical Multimedia Unit (BMU) and the Percy Baxter Room (level 1 Baillieu Library) will also host interactive sessions. Please check the map of the University for conference venues.

Activity	Venue
Registration	Foyer of Economics and Commerce Building
Workshops	Commerce 1, BMU Lab 1, BMU Lab 2, Doug McDonnell Lab

Welcome Reception	Foyer and Courtyard of Economics and Commerce Building
Opening and Closing Ceremonies	Copland Theatre
Keynote Addresses	Copland Theatre
Traditional Presentations	Copland Theatre, Commerce 1, Commerce 2, Commerce 3
Short Presentations	Copland Theatre, Commerce 1, Commerce 2, Commerce 3
Interactive Presentations	BMU Lab 2, Percy Baxter Room
Poster Presentations	Foyer of Copland Lecture Theatre
Controversial Issues	Copland Theatre
Morning and Afternoon Tea	Foyer and Courtyard of Economics and Commerce Building
Lunch	Foyer and Courtyard of Economics and Commerce Building
ASCILITE AGM	Commerce 1
Awards	Copland Theatre
ASCILITE 2002 Launch	Copland Theatre
Conference Dinner	San Remo Ballroom, 365 Nicholson St., North Carlton

Presenters' Room

Presenters who wish to review their presentations can do so in the Tutorial rooms off the Foyer of the Copland Lecture Theatre. Delegates are also free to use the computers in the Percy Baxter (PCs) room and the Biomedical Multimedia Unit Lab 1 (Macs).

Identification

Please wear your name badge at all times during the conference. Without your name badge you may not be admitted to conference sessions. You will notice that some name badges have been coded (see below) to help you identify support staff and keynote speakers.

ASCILITE Executive	EXECUTIVE
Organising Committee & Helpers	ORGANISERS
IT Support IT	SUPPORT
Keynote Speakers	KEYNOTE

Email Access

Delegates can access their email in Lab 1 of the Biomedical Multimedia Unit where 21 computers are available. Email may be accessed via a browser (Netscape or Internet Explorer) or through Telnet. Please be aware that demand for this facility will be high and that a number of delegates may wish to access mail at any one time.

Conference Exhibition

Sponsors will exhibit their products and services in the Foyer of the Economics and Commerce Building. The exhibition will be open from Monday morning through to Wednesday lunchtime.

Welcome Reception

The welcome reception will be held on Sunday 9 December from 6:00 to 8:00 pm in the foyer and courtyard of the Economics and Commerce Building. This is an excellent opportunity to register and catch up with people you have not seen since the last ASCILITE conference. It is also an opportunity for new ASCILITE delegates to be welcomed.

Morning Tea, Lunch, Afternoon Tea

All refreshments will be served in the foyer and courtyard of the Economics and Commerce Building. Benches surround the courtyard and continue around the Economics and Commerce Building (to the north). Benches also surround the South Lawn which is but a short amble away.

Conference Dinner

The ASCILITE Dinner Dance is always a highlight of the conference, and this year's will really be something special. The theme for the dinner dance is the Roaring 20s and Swingin' 30s. Entertainment is provided by Melbourne's seventeen piece big band, The JW Swing Orchestra. Originally the Jubilee Theatre, and more recently the Adelphi Theatre, the San Remo Ballroom was remodelled and renamed in 1963. Boasting a large circular dance floor and high ceilings, the San Remo maintains an intimate atmosphere with the warm timber panelling and ambient lighting, recapturing the style and romance of the Art Deco era. Don't forget to bring your costume. The San Remo Ballroom is located at 365 Nicholson St, North Carlton.

Local Restaurants

The University of Melbourne is located in one of the premier restaurant districts in the city. Lygon Street is a five minute walk (east) and bustles with fantastic restaurants to suit all tastes and budgets. The conference organisers have prepared a list of restaurants which can be reviewed at the registration desk. Or simply wander down and see what takes your fancy!

The ASCILITE and Conference Awards

The prestigious ASCILITE Awards will be presented in the final session of the conference on Wednesday 12 December. Awards will be presented in the categories of "Best web application of computers to teaching and learning" and "Best CD-ROM application of computers to teaching and learning". Every year a number of outstanding papers are also recognised at the ASCILITE conference. Best paper presentations will also be made in the final session.

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THE UNIVERSITY OF MELBOURNE

ASCILITE

biomedical multimedia unit

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program

Back

Title: Implementing Collaborative Learning Environment Workshops

Presenters:

- **Mr. Paul Fritze**, (Teaching, Learning and Research Services, University of Melbourne)
- **Dr. Helen Kavnoudias**,
- **Dr. Robert E. Kemm** &
- **Dr. Neil Williams** (Department of Physiology, The University of Melbourne)

Intended Audience:

The workshop would be of interest to university lecturers, teachers and educational technology developers interested in using online technologies to enhance the on-campus workshop experience. Many of the issues raised would also be relevant to flexible or mixed delivery modes. The workshop also serves as an introduction to the Online CourseWare Component Architecture (OCCA) as used at the University of Melbourne. No prerequisites are required other than familiarity with Web browsers.

Objectives:

The ASCILTE workshop will be conducted within a CLE setting, with participants working in groups of 3-4 to a computer. Participants will:

- gain first hand experience as a learner within a CLE setting; the physical setting, group dynamics, face-to-face and online interactions, role of tutors etc.
- investigate a particular issue related to CLE as the focus of their workshop experience.
- using a learning requirements framework, categorise opportunities for articulation, feedback, adaptation and reflection provided by both online and face-to-face techniques for individuals, groups and peers.
- identify new roles and tasks for teachers and tutors as 'facilitutors'.
- observe how simple OCCA Web pages can stimulate learning, record progress and provide an environment for monitoring and responding to students.
- contribute to further discussion about CLEs through reflection on the CLE activity and prior experiences.

The Instructors:

Paul Fritze is a member of academic staff of TeLaRS and has wide experience in instructional design, software development, professional development, evaluation and educational technology research. He is the principal developer of the Online Courseware Component Architecture used in the online component of this workshop. Paul has been involved in developing and running many development workshops, seminars and courses for University academic staff, post-graduate students and external clients. The development of OCCA is the outcome of several years' work involving close collaborations with teaching staff in curriculum projects across many disciplines. Paul worked particularly closely with the Physiology Department in the development and implementation of a successful CLE that forms the basis of this workshop. Prior to ASCILITE, the CLE workshop will be run for the staff development program of Centre for the Study of Higher Education.

Dr Helen Kavnoudias is a senior tutor who has been instrumental in the development and implementation of CLE workshops in the Department of Physiology. As well as working very closely with TeLaRS in structuring the operation of the online component of these workshops, she has great experience and understanding of the student learning gained through her experience as a tutor and work in subject evaluations. She has been responsible for managing and training tutors, who are usually post-graduate students. As part of this, she has organised training workshops on tutoring within collaborative learning environments.

Dr. Robert Kemm has 30 years experience in developing, researching and implementing innovative approaches to learning using computers in tertiary education. His present interests include developing approaches to learning using a wide range of interactive multimedia and to small group computer aided collaborative learning. He heads the Multimedia Unit within his University Department, which generates and runs on-campus collaborative/interactive computer teaching programs based around Web based presentations, dedicated stand alone modules and small group interactive research tasks. Most recently, his activities have been recognised as an Invited Speaker to ED-Media 2000 in Montreal. Dr Kemm is Head of the Education Commission of Federation of Asian & Oceanic Physiological Societies and a Member of the Education Commission of International Union of Physiological Societies. He is on the editorial boards of Advances in Physiology Education and Journal of Interactive Learning Research. Dr Kemm maintains an active role in supporting computer aided teaching initiatives worldwide. He is invited to organise and has run many computer based teaching workshops for international physiology societies since 1994.

Dr. Neil Williams has been responsible for curriculum development within the Department of Physiology for the past 10 years and together with Dr Kemm has developed innovative approaches to learning within the Science Curriculum, especially with the aim of teaching Physiology through many of the professional practices used by scientists.

Workshop Format:

Introduction

Introductions, workshop overview and organisation of participants into groups of 3-4.

1. Hands-on CLE session:

The first section will be run in the manner of a regular student CLE workshop. Participants will work in groups at a computer running the workshop Website. The Website will guide activities and record responses, although the emphasis is on group discussion. The workshop presenters will act as 'tutors' to prompt discussion and answer queries. Members of each group will together:

- Choose a broad question related to CLEs, such as: "What is the role of tutors in running a CLE workshop and how can it be facilitated?"
- Brainstorm the question, recording a summary of key points.
- Reconsider their initial response in the light of suggestions provided online, post the first draft to a peer group for review.
- As peer reviewers, each group will annotate work of another group against given criteria: Is the question been addressed? Suggested additional themes, Errors of fact etc.
- Respond to peer review of their own first draft and produce final report.
- Complete an online survey on the experience of undertaking a CLE workshop.

2. Class discussion:

In this section, participants will reflect on the hands-on experience. Using a given learning framework, they will identify online and face-to-face activities that made up elements of learning such as articulation, feedback, adaptation, and reflection elements.

Online summaries of the survey and demonstration of the tutor's view of their work will provide foundations of a broader discussion of themes such as:

- Group dynamics
- Techniques for tutors
- Assessment strategies
- Problems experienced
- Balance of CFL and traditional modes
- Evaluation strategies

3. Demonstration of techniques and developed CLEs

OCCA-based learning models and evaluation outcomes from other projects at Melbourne University will be demonstrated and discussed. Pedagogical exemplars emerging from different settings will be illustrated, for example learning portfolios, immediate feedback, self-assessment, learning maps, group work, peer interactions, reflective tasks, embedded evaluation. Finally, examples of optimised teaching environments will show how teaching can be facilitated.

The group reports and discussion outcomes from the workshop will be made available online to the participants in a follow up Website.

Recent relevant publications (two additional papers submitted to ASCILITE 2001)

Fritze, P. A., Kavnoudias, H., Kemm, R. E. and Williams, N. (2001). Developing a Collaborative Learning Environment in Physiology - Using an Online Architecture to Link Faculty and Institution Needs. Proceedings of the Ed-Media 2000 Conference, Tampere, Finland, Association for the Advancement of Computing in Education.

Kemm, R. E., Kavnoudias, H., Fritze, P. A., Stone, N. and Williams, N. (2001). Peer learning of key scientific concepts in a web-based on-campus collaborative learning environment. Submitted to Ed-Media 2001, Tampere, Association for the Advancement of Computing in Education.

Kemm, R. E., Kavnoudias, H., Weaver, D. A., Fritze, P. A., Stone, N. and Williams, N. T. (2000). Collaborative Learning: an Effective and Enjoyable Experience! A Successful Computer-Facilitated Environment for Tertiary Students. Proceedings of the Ed-Media 2000 Conference, Montreal, Association for the Advancement of Computing in Education.

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program

Back

Title: External peer-review of the quality of learning objects

Presenters:

Peter G. Taylor and colleagues
Griffith Institute for Higher Education
Mt Gravatt Campus
Griffith University
Email: peter.taylor@mailbox.gu.edu.au

Introduction

This workshop will share progress in the development of a system-wide scheme to provide independent expert review of the quality of the ICT-based learning objects developed to support student learning in Australian universities. The operationalisation of the scheme depends on collaboration between universities, journal editors, resource creators and expert reviewers, and the AUTC-funded project, "*Information and Communication Technologies and Their Role in Flexible Learning*".

Intended audience:

This workshop is intended for the widest possible audience of ASCILITE participants. The scheme has direct relevance to:

- anyone involved in supporting the development of learning objects;
- anyone interested in the validation of the quality of learning objects;
- anyone interested in participating in the scheme either as contributors of learning objects for review, or undertaking the role of reviewer;
- anyone interested in the use of meta-data to assist in the discovery of learning objects.

Objectives:

Those who attend will:

- gain a clear understanding of how the scheme is operating in this trial phase;
- explore examples of reviewed resources and the review process;
- experience the review process;

- have the opportunity to discuss how they might make use of the scheme and its outcomes.

This workshop will provide an opportunity for conference participants to engage with a project to develop a national scheme to provide peer review of ICT-based teaching and learning resources, ie, 'learning objects'. The project involved an initial development of the conceptual and procedural resources necessary for the implementation of the scheme. That stage of the project was supported by EIP funding by DETYA, completed in 2000, and reported in Taylor and Richardson (2001).

The workshop will introduce participants to the operation of the scheme through inviting their engagement with the procedures and resources developed during the trial stage of the scheme, begun in November 2000, and continuing until the end of 2001. HEIP funding support for this work has been provided by DETYA.

We believe that this work will be of considerable interest to ASCILITE members given its focus on validating the quality the scholarship of teaching (Boyer 1990) that is evidenced in and through the design and construction of learning objects. It also builds on the work of Carmel McNaught, Rob Phillips, Darrien Rossiter and Jenny Winn, reported in the EIP report "*Developing a Framework for a Useable and Useful Inventory of Computer-facilitated Learning and Support Materials in Australian Universities*" (McNaught et al 2000). The development of a framework to guide those involved in the review process is seen as a significant contribution to efforts to develop a shared understanding of the essential elements of effective design of teaching. This framework has been aligned with the work of the AUTC-project group (mentioned above), led by Barry Harper, Ron Oliver and John Hedberg. The framework can be readily adapted for use in personal reflection of teaching, review by students, and/or review by 'local' peers, as is being trialed by staff at James Cook University. Thus the resources developed through the project should contribute to the recognition and reward of highly effective teaching irrespective of whether that teaching involves the use of ICTs.

In particular, the workshop will provide an overview of the operation of the scheme and access to the resources developed to support both the trial of the scheme. That trial is being conducted in Edith Cowan University, Griffith University, James Cook University, RMIT, the University of Sydney, and the University of Wollongong. The workshop will provide an opportunity for participants to gain an insight into the schemes' operation and potential, including an opportunity to use the Review Proforma to review sets of resources.

Staff development resources have been developed to introduce the scheme to three key stakeholder groups: journal editors; resource creators; and, potential peer reviewers. In addition staff development strategies and resources have been developed for use within institutions to introduce the scheme to those involved in staff selection and promotion committees. These strategies and resources are being trialed.

Our intention is to provide workshop participants with an opportunity to explore and provide feedback on the scheme and the resources that have been developed to support its implementation. That feedback will be used to assist us in the ongoing establishment of the project, while the workshop will assist in the expansion of the scheme.

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Taylor, P.G. and Richardson, A.S. (2001) *Peering at Scholarship in University Teaching: Constructing a national scheme for external peer review of ICT-based teaching and learning resources*. Draft EIP report, sent to DETYA on 20 October 2000.

Workshop presenter:

Peter Taylor is a Senior Lecturer in the Griffith Institute for Higher Education at Griffith University. The focus of his work is staff, student, and organisational development for flexible learning, including the design, use and research of new learning environments. He has over 25 years experience as a teacher, and been engaged in academic staff development for the last seven years. Peter's research interests cover a wide spectrum - pedagogy, flexible learning, and academic life. In 1999 the Open University Press published his book *Making Sense of Academic Life: Academics, Universities and Change*.

The workshop will also be supported by other members of the Project Team, including Craig Zimitat and Brad Young.

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program

Back

Title: Instructional Design for Distance Education: What's Different?

Presenters:

- **Doreen Gosmire** and
- **Karen Norum**

Audience:

Instructors who deliver courses using distance technologies such as the internet and interactive TV. Instructors who are beginning to deliver courses using distance technologies. Those who are interested in what is different about designing instruction for distance delivery. The optimal audience size would be a range from 8-25.

Rationale

Designing courses for distance delivery requires extensive planning. Learning activities that take place naturally in a face-to-face setting need to be purposely structured into a distance delivered course. "It is essential to consider elements such as the content, the learner, the strategies for teaching, and the means of assessing the learning experience" (Smaldino, 1999, p. 9).

This workshop will provide a way for participants to reflect on their current teaching beliefs and strategies. They will consider how those beliefs influence course design (whether it is face-to-face or distance) and determine how instructional design for distance delivery is different from designing for a face-to-face environment. This workshop is based on a 14-hour workshop we offered to faculty at the University of South Dakota through the Center for Instructional Design and Delivery in Summer 2001.

Objectives

- Examine personal beliefs about learning and reflect on how those beliefs influence the design of courses.
- Become familiar with constructivist learning theory and its role in instructional design.
- Become familiar with instructional design models.
- Be able to match the appropriate technology with the level of interaction desired.

- Gain confidence in course management issues and concerns.
- Become familiar with current issues and research being conducted in this arena.
- Understand why designing for distance delivery is different than instructional design for a face-to-face setting.

Format

Participants will examine their beliefs about learning and determine how those beliefs influence the design of their courses. This will be accomplished by participants interviewing each other about their best learning experience and discussing the common themes. We will then discuss as a large group, what the implications of this activity are for the design of distance delivered courses.

Present an overview of constructivist learning theory and its role in instructional Design. This will be done through a short presentation and discussion.

Present an overview of instructional design models: traditional and emerging models. This will be done through a short presentation followed by discussion. If available, participants can spend some time reviewing a website.

Present an overview of Bloom's Taxonomy and use it to determine what kind of technology is appropriate for the level of interaction desired. This will be accomplished through a short presentation, discussion, and a small group activity.

Discussion of teaching strategies with an emphasis on what can be done by distance that cannot be done face-to-face. This will be accomplished through a small and large group discussion.

Discussion of course management issues: managing asynchronous and synchronous discussions; group projects; general course communication. If available, we will have students try out these online course tools.

Discussion of caveats and concerns: Do people learn as well by distance as they do face-to-face? We will present findings from the "no significant difference" research as well as from our own research.

Presenters

Doreen Gosmire is an Assistant Professor of Technology for Training and Development at the University of South Dakota. She received her Ed.D. from the University of Nebraska-Lincoln in 1995. Her background includes instructional design, learning theory, leadership training, distance education and theory. She serves as the Director of the Distance Teaching and Learning Academy for the State of South Dakota. She has taught courses by distance using both interactive TV and web-basedtechnologies.

Karen Norum is an Assistant Professor of Technology for Training and Development at the University of South Dakota. She received her Ph.D. from the University of Colorado at Denver in 1997. Her background includes instructional design, learning theory, organizational theory and development, organizational systemic change, and qualitative research. She has delivered courses by distance, primarily web-based, using Web CT.

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Title: WebQuests: An Inquiry Based Instructional Strategy Using the Internet

Presenters:

- **Maureen Brown Yoder**, Lesley University

Intended Audience

The intended audience is anyone interested in creating a Web based lesson for either a face to face or online class. Participants should be familiar enough with a Web browser to be able to navigate through Web sites and use search engines. Workshop participants will be creating a very simple Web page, with text and links, but no experience is necessary.

Objectives

Participants will be introduced to the WebQuest, an instructional strategy that consists of an inquiry based lesson on an instructor made Web page with links to Internet resources. WebQuests provide a responsible use of the Internet with curriculum based challenges and timely resources. Why are instructors using WebQuests? How are they increasing motivation and learning among students? This session will address these questions and discuss the educational benefits of WebQuests. The workshop leader will demonstrate why WebQuests have become popular, show examples of exemplary ones, demonstrate how to find them, and instruct participants in the process of creating their own by using the abundantly available resources. By the end of the workshop, participants will have identified a need and will have begun to design a WebQuest of their own that will fulfill an objective in their professional life.

Introduction and Definition of WebQuests

A good WebQuest represents good pedagogy. As it was conceived by Bernie Dodge and Tom March, a WebQuest is a curriculum based inquiry activity with well chosen Internet resources within well defined tasks. The inquiry orientation requires high order thinking skills applied to the challenging questions presented to the students, and then solved using the best of Internet resources for a particular curriculum area. The structure of a Webquest generally fosters collaboration, and at least one outcome calls for the presentation of the students' newly acquired knowledge, sometimes in an interactive multimedia format. As students meet the challenges of WebQuests, they use and develop a variety of technology skills.

The Origin of WebQuests

In 1995, at San Diego State University, Bernie Dodge and Tom March developed a lesson plan template that incorporated World Wide Web links. A scenario and a task were presented to students and they were given well chosen Internet resources to address their questions. They had to analyze the information and come up with their own creative solutions. Dodge suggests six parts for a WebQuest: the Introduction, the Tasks, the Process, the Resources, the Evaluation, and the Conclusion. On his Web page are detailed explanations and examples of each part.

Over the next five years, instructors began to teach the WebQuest concept to teachers in classes and workshops. Fortunately, teachers published their WebQuests on the Web and collections of teacher created projects for all grade levels and subject areas became available.

Why are instructors using WebQuests? How are they increasing motivation and learning among students? Successful use of WebQuests results in students collaborating with one another and using technology in a productive, educationally sound way. If the opening challenge, or scenario of a WebQuest, is compelling and motivating, then students become involved in exploration and problem solving then gathering original data and putting together a product that demonstrates what they have learned. Various learning styles can be addressed. This workshop will include examples of student and teacher findings and testimonials.

Finding High Quality WebQuests:

There are thousands of WebQuests available that teachers can evaluate and adapt for their own use. Bernie Dodge and Tom March have lists on their Web pages along with guidelines on how to create your own, Kathy Schrock's Web page has examples as well as a slide show on creating a WebQuest. Also, there are hundreds of sites posted by school systems, universities, and teacher resource centers with collections of WebQuests.

The words "WebQuest" or "Web Quest" can be typed into a search engine or directory to find many individual WebQuests as well as collections. Most have the author's email address, making it easy to contact the author to ask permission to use all or a part of their page.

Examples:

Internet resources for WebQuests:

- Bernie Dodge's The WebQuest Page - http://edweb.sdsu.edu/webquest/webquest.html includes the Building Blocks for writing your own WebQuest
- Tom March's Page - http://ozline.com/webquests/intro.html includes compelling reasons to use WebQuests and a guide to designing them.
- Kathy Schrock's page -

http://school.discovery.com/schrockguide/webquest/webquest.html has a slide show with guidelines for the development of WebQuests

Conclusion

This workshop will consist of a thorough exploration of the WebQuest and its implications for teachers and students at all levels. WebQuests represent responsible use of the Internet and good pedagogy by involving students in inquiry using the best resources the Web has to offer. Even novice technology users can develop and use WebQuests in their traditional or virtual classrooms. This session will show them how.

A summary of the workshop presenter's qualifications Maureen Brown Yoder EdD, Professor, at Lesley University in Cambridge Massachusetts, has written one of the definitive articles on WebQuests: The Student WebQuest. (Yoder, 1999). http://206.58.233.20/L&L/archive/vol26/no7/features/yoder/index.html. She has also developed an online course in WebQuests for Classroom Connect, and is the Program Director for the Lesley University online graduate program in Technology in Education. She teaches and advises teachers in an asynchronous environment, developing and promoting Internet based instructional strategies that will actively engage educators and their students.

Dr. Yoder teaches the graduate course: Telecommunications: Curriculum in A Global Context for Lesley University, in both a site based and an online format to students locally and internationally. She is particularly interested in the facilitation of online discussions and the creation of online learning communities, and uses WebQuests in her face-to-face and online instruction.

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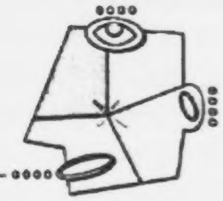

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Title: *interActive Learning Online...or...* how to relate to your students when you can't see their faces

Presenters:

- **Meg O'Reilly** is an educational designer at Southern Cross University, and co-author of the book *Assessing Open and Distance Learners*, 1999 Kogan Page.

Intended Audience and degree of prior expertise required:

The workshop is suitable for all academic staff who would like to experience a variety of interActivities both as learners and group facilitators. No experience is required in online discussion forums, though previous classroom teaching experiences would provide realistic scenarios to draw from as a launchpad for design of interActivities.

Background:

The staff development program *interActive Learning Online*, was conceived after five semesters of course development for the online environment. Initial momentum for online course development involved reconfiguring distance education materials and study packages for the screen-based environment. In terms of working with academics who were early adopters of technology in teaching, educational designers also proactively supported a reconceptualising of their pedagogical approaches in order to promote and maintain the process of active learning for both off-campus students and the staff themselves.

During this time of change, the great majority of academic staff at Southern Cross University have been active in identifying their own staff development needs. In particular, the need for experiencing a variety of forms of dialogue and interaction in, and with, the web and screen based environments, has been identified as a focus of interest. While both staff and students are now gaining more exposure to the online environment, the emphasis on gaining direct experience is clearly evident since teaching staff are aiming to gain online experience while also avoiding trial-and-error experimentation with their students. Quality and effectiveness of online interAction is now of concern in both off-campus and on-campus programs.

In direct response to this identified need for more experience in ways of relating as teachers and learners online, the staff development resource *interActive Learning Online* has been developed for use as both a stand-alone self-paced tutorial as well as for use as a facilitated timetabled activity.

Aims and objectives:

This workshop aims to provide an opportunity for teaching staff to undertake online interActivities in a concentrated format, to reflect and discuss the effectiveness of online navigation, dialogue and interaction strategies as they are experienced. By the end of the workshop, participants will be able to:

- design an online interactive learning activity for their own disciplinary context
- facilitate at least one group interActivity online
- evaluate the match between the design of their online interActivity and the outcomes of the interActivity

Program:

1. Exploring your disciplinary context

The first session of the workshop will provide the opportunity for participants to introduce themselves and, through the online medium, to consider the nature of their disciplinary context. Participants will reflect upon their own teaching and learning philosophies which underpin their orientation to curriculum.

Through a facilitated online forum, this session will encourage participants to consider ways in which these philosophical underpinnings might inform their approaches to teaching and learning online. Participants will reflect on the range of learning outcomes which pertain to their subject areas, and also define how students might gain from opportunities to interact electronically with course materials, with other students and with the teacher.

2. Exploring the environment for interaction

Discussion in the second forum will be facilitated to support critical reflection on the array of web-based communication tools now available to us as academics. What are the strengths and limitations of these various forms of communication?

We will introduce the online environment in the context of Blackboard CourseInfo. Issues which will be explored include the effective use of hypertext, and whether it leads to a fundamentally different kind of reading/ learning experience.

3. Go for it!

This forum requires participants to move into roles as students, immersed in this online environment, exchanging views and collaborating with your peers and teacher. An email game will be jointly selected and used for the core experience of this session. The focus of the games will be structured to address the core questions of teaching and learning interactively online.

Ideas for consideration might include: "What strategies for organising classes and setting up communication exchanges have you found to be successful with your students? What strategies have not worked well? In what ways does the web offer opportunities for 'transformative' learning that may not be available in traditional class-room and distance modes of education? In what sense do web-based learning communities compare with, or fall short of, the kinds of 'transformative' learning experiences that can occur in face-to-face interactions?"

4. mmm, what have we learned?

We will use the final part of the session to focus on issues relating to new forms of assessment available through electronic media and how we can evaluate the effectiveness of our online programs. In particular the questions around assessment of dialogue, interaction and active discussion will be considered.

This forum will also be used for a facilitated formal feedback session. We will be looking for feedback from participants on the sessions and resources offered in this staff development workshop. Questions to be asked include: "What have you gained from it? What worked well, could be done better, has been overlooked, etc?"

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Title: Creating and Using Web-Based Simulations in Educational and Organizational Environments

Presenters:

Albert Ip (albert@dls.au.com) & **Roni Linser** (roni@ausis.com.au)

Intended audience

Any academic interested in providing learners with an engaging, fun and rewarding learning experience using role play simulation. Required skill is the ability to browse the web and enter information using Web-based forms. Some knowledge of HTML tags is useful but not necessary.

Clear statement of the objectives of the workshop

At the end of the workshop, participants will

- Articulate the pedagogical underpinning of,
- Design, and
- Deliver a role play simulation using Fablusi™ system.

Workshop Activities

Simulations have been used as a tool for teaching in many areas and disciplines. The idea behind using simulations as pedagogical tools relies on the idea that experience is the best teacher. If access to such experience in real-time is impossible, an artificial environment may be, if not ideal, at least sufficient.

The simulations described in this workshop are not rule-based simulations of physical systems. Our simulations are role-play simulation for modeling human interactions, such as those encountered in political science studies or management studies. One of the early pedagogical applications of the generator was a dynamic goal-based scenario design in the study of world politics at the Political Science Dept. at the University of Melbourne. End of course evaluation showed positive experience of the students. (http://www.roleplaysim.org/papers/polsim.htm).

In the first part of this workshop, the pedagogical underpinning of role play simulation (based on our experience in running political science and other professional development courses) is explained to illustrate how role-play simulation can be used to create an engaging learning experience for the students. Techniques in using role-play simulation in educational and organizational environments will be discussed. The simulation is in fact generated using Fablusi™, a RPS generator, which is based on the abstraction that human interactions are communicative events requiring information exchange (http://www.roleplaysim.org/papers/rpsg.htm). Fablusi™ greatly reduces the routine task of creating simulation.

The second part of the workshop will engage the participants in an online role-play simulation based on a simulation generated by Fablusi™. This will help the participants to gain a first hand experience from a student's point of view in working through a simulation in the learning process.

A brain storming session then follows at which participants can attempt to design learning scenarios. Participants are asked to come to the workshop after reading the papers cited above to get an idea of what sort of ideas can be used. This part of the workshop will assist the participants to create their own online simulation using the generator and test run the collective creative work.

Finally, we shall discuss the issues and needs of skills in moderating a simulation, the joy and woe from a lecturer's point of view. Selected simulations will be available online for use in the participants' own classroom (worth over AUD500 depending on the number of seats in their simulations).

About the Presenters:

Mr. Ip has a long history of working in learning technology. In 1986, he designed MonNet, which was able to broadcast the image from a teacher's computer to the students' workstations using a low cost overriding mechanism. In 1986, Albert and his students designed, and built a Local Area Network for Apple II computers. He later shifted his focus towards software implementations. In 1994, he had designed TeleNex, an English language teacher support system for the University of Hong Kong incorporating hypertext database, automatic generation of test items, online asynchronous conferencing and English corpus database. Mr. Ip's latest work is on the Role-Play Simulation Generator, which is based on his research on scalable learning architecture for Internet. He is currently, the Managing Director of *Digital Learning Systems P/L*, a company that provides online learning solutions to educational and training institutions.

Mr. Linser was lecturer in the Political Science Department at the University of Melbourne where he has been running simulations on the Internet since 1992. He has published a number of papers on the use and pedagogical foundations of simulations on the Internet. In the last 3 years, he successfully ran several large-scale web-based simulations (some with over 40 roles each and generating over 5000 messages each) in International Relations, Russian Politics, Middle East Politics, Politics of the Asia-Pacific region and Australian Foreign Policy. More recently he set up and is conducting web-based simulations for professional training of teachers from several South Australian TAFE institutes using Fablusi™. He is currently the Managing Director of *Ausis P/L* - a company that provides commercial online shopping to business clients and online professional training solutions to educational and training institutions.

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Title: Assessing student learning: Expanding assessment to include a focus on process as well as content outcomes

Presenters:

- **Alex Radloff**, RMIT University
- **Barbara de la Harpe**, Curtin University of Technology

Rationale

We don't pay a lot of attention right now to giving students feedback on their progress as learners. Mostly, students get grades that tell them how they have done relative to their classmates. That information is not useful feedback on their progress as learners, nor does it do anything to help students develop skills for self-assessment (Cross, 1998, p. 7).

Traditional assessment often focuses on narrow abilities such as memorization, fails to provide useful feedback to either teachers or students about the process of learning and allows minimal student involvement in assessment. Such an approach to assessment contributes little to the development of students as effective lifelong learners. Educational outcomes important for lifelong learning and espoused by most university teachers, namely student motivation, beliefs and feelings, and cognitive and metacognitive abilities, are largely overlooked in the traditional teacher-centred, content-focused transmission model of teaching and learning, where assessment focuses on the "...products of learning" rather on the "...how and why of student learning" (Anderson, 1998, p. 8).

Objectives

The purpose of this workshop is to explore how assessment can be expanded to include a focus on the process of learning that will help both teachers and students to enhance the quality of teaching and learning. The workshop will include - based on theory and research - examples of effective assessment tools and strategies for assessing educational outcomes in terms of student motivation, affect and cognitive and metacognitive abilities, and discuss how these can be used in a range of educational settings.

Maximum number of participants: 25

The workshop is designed to encourage participant involvement, interaction, collaboration, reflection and feedback in a safe learning environment. The workshop will be especially relevant for university teachers, administrators and student advisors who are committed to improving educational outcomes and encouraging lifelong learning.

References

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Cross, K. P. (1998). Classroom research: Implementing the scholarship of teaching. In T. Angelo (Eds.), *Classroom assessment and research: An update on uses, approaches, and research findings* (pp. 5-12). San Francisco: Jossey-Bass.

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Title: Engaged Learning: Using concrete simulations to teach about an online world

Presenters:

Michael O'Brien
The University of Melbourne

Intended Audience and degree of expertise required:

IT and Teacher Education academics; no IT expertise required.

Objectives:

This workshop takes as its focus the **Innovation** Theme, looking at **Creative Solutions** to **Overcoming Limitations** in teaching about **Emerging Technologies**.

When IT resources are scarce or in high demand, whole class or large group activities using learning technologies can be logistically challenging. A response to this challenge is to devise creative 'low tech' teaching strategies that can still powerfully explore terminology and issues encountered in the online world.

In this workshop, participants will be introduced to activities that have been used successfully with teacher education students in the University of Melbourne';s B.Ed Primary course's "Computers and the Primary Classroom" subject.

These activities have been used with Primary School students, and as part of inservice activities for practicing Primary School teachers.

Format:

This workshop uses concrete simulations to teach about an online world.

The workshop will be supported by a PowerPoint presentation featuring images and video of the activities the participants will take part in.

Identifying the Problem

Whole class or large group activities using learning technologies present logistical challenges when IT resources are:

- scarce
- or in high demand

Responding to the Problem

- Educators can devise creative 'low tech' activities that can still powerfully explore terminology and issues encountered in the online world.

Passive vs. Engaged Learning

- Discuss the differences between engaged and passive learning (Project Pegasus,1999).
- If computer resources are limited - or even non-existent - the challenge is to find or develop materials for students that will engage them and enable them to gain an understanding of and confidence about online technology.

Introduce Activities

- Used with teacher education students in the University of Melbourne's B.Ed Primary course's "Computers and the Primary Classroom" subject.
- Also been used with Primary School students, and as part of inservice activities for practicing Primary School teachers.
- They are effective because they start with existing reference points the students understand.
- Abstract concepts such as hosts, packets, glitches, security, anonymity, confidentiality, acceptable use, 'spam', the perils of 'chatrooms' and even cyclical redundancy checking become clear when students use concrete objects such as balls, pens and
- paper, and each other to explore the issues.
- By engaging in the learning process, the students are able to gain an understanding of issues relating to being online and how the Internet works, in ways passively listening to a lecturer standing at the front of the room - or even watching a slick multimedia presentation - cannot.

PaperNet Activity

- Activity co-developed by the senior author (O'Brien & Nicola 1998) is a 'pen and paper' exercise that introduces issues raised by online chat and email.
- If an organisation is developing an Acceptable Use Policy, active engagement in this exercise could help the participants involved understand the implications of such a document.
- ***Workshop participants will take part in PaperNet Activity (approx. 30-40 minutes)***

PaperNet Discussion

Following the activities, complex issues can be discussed and explored further.

During a debriefing discussion questions that might arise include:

- *What are the advantages/disadvantages of being anonymous on the Internet?*
- *How easy is it to pretend you are someone else? What implications does this have when communicating online?*
- *Should ISPs be responsible for what people say to each other over the net?*
- *Did anyone send or receive a bogus message? Discuss the implications of this kind of online behavior.*
- *How do we know someone is who they say they are?*

Should we give our personal details out over the Internet?

- *What things can we do to make using the Internet safe?*

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Comments by student participants

Discuss comments by Year 4, 5 and 6 students (aged 10-12 years) who played the PaperNet game.

At the time - as the school was embarking on an ambitious project where it would eventually serve as a model for 'best practice' in new technologies (EkinSmyth, 1998) - none had ever used email or chat before.

Other Activities

- Introduce Stephen Gard's *The Internet: a resource for Australian Schools* (Gard 1998) as a useful resource.

Internet Ball (Gard 1998)

- Activity demonstrates the original purpose of the Internet: to create a highly reliable system for data communication. If one host in the system is knocked out, there is always another to turn to and the message gets through.
- ***Workshop participants will take part in Internet Ball Activity (approx. 15-20 minutes)***

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Packet Panic (Gard 1998)

- Game that demonstrates how messages are passed over the Internet in 'packets', with 'error-checking' to ensure that the whole message has been passed, and that its parts are reassembled in the correct order at the receiving end.
- The activity vividly demonstrates that modern data transmission techniques ensure almost error-free message handling (cyclical redundancy checking).

Note similarities to the childhood game where a child is given a message and it is whispered to the next child and so on until the last child tells the group the message they received, which after passing through a succession of players invariably ends up different to the original.

Workshop participants will take part in Packet Panic Activity (approx. 15-20 minutes)

Identify where differences lie.

Further Discussion of Activities

Students must learn to use technology well in context.

By immersion in engaged learning activities such as these activities and others like it, students create a scaffold of understanding by operating within paradigms they are comfortable with. Abstract concepts can be explored, discussed, and dissected.

Technology novices can gain confidence and awareness of what awaits them in the online world, even before they have access to a computer or the Internet.

Workshop Presenter's qualifications:

Michael O'Brien
Dip.Teach, B.Ed (Prim), M.Ed Studies

- PhD candidate, Department of Science and Mathematics Education, University of Melbourne
- Tutor/workshop leader for B.Ed Primary, B.Teach and Dip.Ed IT Education courses
- Course co-designer "IT in Primary Schools", 4th year B.Ed subject.
- IT Education consultant for Higher Colleges of Technology, United Arab Emirates
- Screen Literacy consultant for Cinemedia, Victoria
- 1996-1997 Garth Boomer Scholarship fellow, Australian Childrens Television Foundation
- Former primary school teacher (8 years)

References

EkinSmyth, C. (1998) *Rethinking Learning and Teaching: The Navigator Schools' Experience* (Melbourne: Education Victoria)

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Title: A 'Student' Immersion Into A Technologically Assisted Learning Experience: The Fitness, Health and Wellness Gig

Presenters:

Mr Bob Boyd

- Director of Practicum Studies
- Director of Staff Wellness Program
- Lecturer
- Unit Coordinator (including HMB171)

Ms Halima Goss

- Associate Director Online Teaching Coordination, TALSS
- Manager - Software, Multimedia and Internet Learning Environments (SMILE), TALSS

Intended Audience:

Participants who may enjoy being immersed in this experience are academics, teaching and learning support staff, student support staff and post graduate students with an interest in both the integration into teaching and learning of technology supported diagnostic activities and the concepts of Fitness, Health and Wellness.

Expertise Required: Ability to use a web browser

Aims:

To provide workshop participants with:

- A case study demonstrating the integration of instructional and diagnostic technologies into an undergraduate unit
- An opportunity to 'experience' the learning activities utilised within the undergraduate unit
- An opportunity to examine and reflect upon the strategy used to evaluate the effectiveness of the teaching approach

Objectives:

Upon completion of the workshop participants should:

- Be proficient at using the teaching resources used within the unit
- Have considered ways of integrating similar strategies and technologies
- Gained an undergraduate student's perspective of the instructional design used
- Have evaluated the teaching approach experienced

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In this 'compressed semester' workshop participants will undertake learning activities using the technological resources in the same way as QUT undergraduate students do in the unit HMB 171 (Fitness, Health and Wellness). Following the experience, the participants will reflect on the design and delivery of the unit (including the role of the technology) and critique the evaluation strategy used in this unit.

Background Information:

The unit HMB171 is offered in both semesters each year and has an average enrolment of 300 students per semester. It is a first year core unit for all Human Movement students and is also offered as an elective to all QUT students. It was first offered in 1994 as a second semester, second year core unit within the Bachelor of Applied Science (Human Movement Studies) with an enrolment of 68 students. Increasing demand for the unit has catalysed the design of new teaching strategies and associated adoption of new technologies to support the learning objectives within the rationale for the unit.

The rationale of this unit encompasses the following main themes:

- An understanding of the interrelatedness of fitness, health and wellness as a basic premise of individual health related behaviour
- Effective planning and application of personal physical activity programs
- Experiencing a self-determined and self directed personal wellness behaviour change program
- The application of motivational strategies to improve adherence to Personal Wellness Behaviour Change programmes
- Improve the skills, competencies and empathy of the health educator/human movement professional in delivering sustainable physical activity programs aimed at improving client wellness

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An ongoing strategy to ensure the continuous improvement of the student learning outcomes was the implementation of periodic evaluation. Initially, focus groups and paper - based student evaluation surveys were utilised. Recently an online questionnaire was incorporated into the evaluation mix.

Workshop Overview:

The workshop has been designed to provide an insight into the design, delivery and evaluation of major components of the teaching and learning in the unit "Fitness, Health and Wellness" as taught in the QUT School of Human

Movement Studies.

Participants will examine and utilise the technology that has been used to facilitate a number of activities designed to be authentic and immersive for students. The instructional strategies have been selected to enable students through their own personal experiences and characteristics to construct their knowledge of the theoretical and practical foundations of the subject. This unit demonstrates a set of strategies that have been used to provide a constructivist learning environment for a large cohort without the need for extensive increases in teaching staff.

Finally, an examination of the evaluation instrument used to gauge the effectiveness of the learning experiences and teaching tools will enable active discussion about the "unit", the instructional approach taken to scaffold students in constructivist learning environments and the selected evaluation and assessment strategies themselves.

The Workshop Sequence

Introduction

An overview of the "unit" and the discipline will set the scene for the workshop. Participants will be immersed in the topics by developing their own frameworks of the concepts of Fitness, Health and Wellness.

Preparatory activities to enable participants to develop a profile of their personal understanding

Participant on line completion of Wellness Wheel (estimated), Wellness Perceptions Questionnaire, Testwell College Version Wellness Inventory, Wellness Wheel (calculated)

Through these activities, each participant will develop their own private profile that will guide them through the next phases of the learning process. This basis forms the platform for construction of knowledge and understanding.

Delivery of unit's Wellness content

Participants are exposed to theoretical frameworks which will serve as elements in their knowledge construction. This activity will be in the form of a lecturette.

Reflective activity

Participant on line completion of Behaviour Change Guide (personal case study). This will be an opportunity for participants to experience the way undergraduate students integrate the new knowledge into their cognitive domains in order to develop their personal behavioural and developmental objectives.

Repeat participant self-assessment items

The self assessment activity in the condensed "experience" will enable participants to quantify the changes in their understanding and subsequent development. It is aimed at providing a snapshot of the change in growth of knowledge and behaviour as well as being an indicator of improved Wellness.

Participant on line completion of Evaluation Survey

Having completed the unit of study, participants will provide feedback to the instructors. The evaluation survey instrument will serve to highlight the areas that were evaluated in the "real" unit as well as illustrate an online evaluation method which serves to provide ongoing feedback to instructors.

Wrap up

Participant discussion and reflections on the total 'student' experience with an emphasis on the evaluation strategy. The perspectives of workshop participants on a range of issues including activity design, instructional strategies, evaluation strategies and use of technology will be sought and reflections of how these ideas may translate to other units, subjects and teaching strategies will be collated.

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program

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Title: Assessment and On-Line Learning

Presenters:

- **Rod Sims** and
- **Meg O'Reilly**

Introduction

Fred Rossini said that the university of the future will be a network and not a place. What does this mean for teaching, learning and assessment?

The implementation of on-line teaching and learning strategies has not only seen an exponential growth of courses designed for this medium but also the potential for new paradigms of teaching, learning and assessment. In parallel with this growth has been the shift from teacher-centred (*sage on the stage*) to learner-centred (*guide on the side*) programs and the notion of not only just-in-time but also *just-for-you* education. Given this environment, what are the emerging issues in on-line assessment? Do we try and replicate existing assessment methods on-line, or are there different techniques more appropriate to the on-line environment?

This workshop is designed to focus on two specific issues arising from our move into on-line learning in the tertiary environment. The first relates to devising techniques for implementing effective assessment strategies for on-line learning tasks and the second focuses on innovative methods by which to assess collaborative and learner-centred activities in the context of resource-based learning.

To achieve this we will be asking participants to present innovative assessment strategies prior to the workshop so that they can be contextualised within the on-line paradigm, and thereby identifying methods that break from the past.

Objectives

On completion of the workshop, participants will have:

- identified their philosophical position on assessment in the tertiary environment of the future
- access to alternative assessment techniques for on-line teaching and learning
- access to a comprehensive set of readings and resources

Audience

The workshop is intended for participants who are currently working with on-line teaching and learning and wish to enhance their ability to effectively apply assessment strategies in the on-line context.

Each delegate will receive a workshop booklet containing key discussion points, online assessment templates and important readings.

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Format

The first session will be facilitated by Rod Sims, providing a theoretical context for assessment and issues confronting the use of the old with the new. The second session will be convened by Meg O'Reilly who will focus on the current strategies employed by participants and their level of effectiveness within an on-line environment.

Delegates will be involved in a range of activities and dialogue focusing on a series of questions and issues identified within the workshop notes. More importantly, the workshop will provide a means for delegates to identify their particular concerns for assessment in online environments and "workshop" potential solutions.

Content

The workshop will address the following topic areas:

- The value of applying traditional assessment protocols in an on-line context.
- Is the enrolled virtual student the same person submitting the assessment?
- Strategies for assessing on-line learning tasks
- Blending of formative and summative assessments
- Assessing new skills such as information literacy, text-based communication, collaborative learning
- Staff workload, the "active student" and reusable learning resources
- Authentication and authentic assessment activities

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About the Presenters

Dr Rod Sims is Associate Professor and Director of Learning Environments at Deakin University; he has over 20 years experience in the design and development of interactive learning systems. Rod has national and international recognition of his work and is currently responsible for the implementation of major online learning applications at Deakin University.

Meg O'Reilly is Lecturer, Educational Designer in the Teaching and Learning Centre, Southern Cross University. Meg's role includes staff development as well as the design and development of teaching, learning and assessment strategies for a flexible educational environment. Recent publications include the book

"Assessing Open and Distance Learners" co-authored with colleague Chris Morgan, as well as several chapters on research pertaining to issues emerging as a result of online assessment.

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Title: Developing 3D Virtual Learning Environments

Presenters:

Barney Dalgarno
Charles Sturt University
bdalgarno@csu.edu.au

Intended Audience

Developers of technology-based educational resources.

It is expected that participants will have the following prerequisite experience:

- Web page development, including experience with directly coding HTML.
- Use of graphics software such as Photoshop or equivalent (knowledge of specific graphics software will not be assumed).

Objectives

It is anticipated that at the end of the workshop participants will be able to:

- Understand terminology pertaining to 3D environments, such as modelling, rendering, hardware acceleration, avatar, texture, lighting, collision detection, vertex, polygon and surface.
- Discuss the role of the various technologies pertaining to 3D learning environments, including (but not limited to) VRML, Active Worlds, Direct3D and OpenGL.
- Discuss the capabilities of the various tools that might be involved in developing a 3D learning environment, including (but not limited to) 3D Studio, Caligari trueSpace, Extreme 3D and Cosmo Worlds.
- Discuss and compare the various platforms that support multi-user 3D learning environments, including the Blaxxun Virtual Worlds Platform and Active Worlds Universe.
- Use a VRML browser such as Blaxxun Contact to move around, interact and communicate within a VRML environment.
- Use the Active Worlds browser to move around, interact and communicate within an Active Worlds environment.
- Use a modelling tool such as Caligaru trueSpace to create a simple 3D object to be used as a personal avatar within Blaxxun or Active Worlds.
- Use a text editor to create a simple VRML world.

Workshop Description

The workshop will begin with a discussion of 3D learning environments, their pedagogical basis and the technologies involved. Examples of 3D learning environments will be briefly demonstrated to help explain the ideas discussed. It is anticipated that this discussion and demonstration will be about one hour long.

The remainder of the workshop will consist of hands on exercises. Firstly, participants will explore, interact and communicate within various 3D learning environments. They will then develop a simple 3D object to be used as a personal avatar within a 3D environment. Lastly, they will develop a very simple 3D environment.

Presenter's Qualifications

Barney Dalgarno is a lecturer in Information Technology at Charles Sturt University. His qualifications are: Bachelor of Science (ANU), Graduate Diploma in Education (University of Canberra), Master of Applied Science (University of Canberra). His masters thesis was titled, *Constructivist Computer Assisted Learning: Theory, Technique and Tools.*

Barney has 14 years experience as an Information Technology educator, including workplace training, secondary and tertiary education. He has also published extensively in the learning technology area, including more than 20 refereed journal articles and conference papers.

Barney currently leads a team that is developing a 3D virtual chemistry laboratory, which, as well as being used in chemistry teaching as Charles Sturt University, will be a vehicle for addressing research questions relating to 3D learning environments in general.

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Keynote Presentations

Koschmann, T. (2001).
Revisiting the paradigms of instructional technology.

Radloff, A. (2001).
Getting online: The challenges for academic staff and institutional leaders.

Rieber, L. (2001).
Designing learning environments that excite serious play.

REVISITING THE PARADIGMS OF INSTRUCTIONAL TECHNOLOGY

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Abstract

In this paper I revisit a previously-published analysis of paradigm shifts within research on instructional technology (IT). Following Kuhn, I will use the term 'paradigm' to denote an actual scientific achievement. Used in this way, a particular experiment or research study must meet two criteria to qualify as a paradigm: it must be novel, that is it must be demonstratively different from those that came before and it must be sufficiently open-ended to provide a basis for further work. In the original analysis, I identified four paradigms operating in IT research (i.e., CAI, ITS, Logo-as-Latin, CSCL). I re-evaluate the evidence for each of these putative paradigms and attempt to sharpen the original analysis. In so doing, I focus in particular on the CSCL paradigm and assess its status as an emerging paradigm. Conducting a Kuhnian analysis of IT research is useful for at least two reasons. First, it provides a means of rationalizing and lending order to the vast range of activities that fall into this broad area of research. Second, such an analysis provides an opportunity for reflection—reflection on where the field has been and where the field might be going.

Keywords

paradigm shifts, research methodology, theories of learning, learning technologies

Introduction

Roughly five years ago I was faced with the task of writing an introductory chapter for an edited collection on CSCL (Koschmann, 1996). In this introduction, which I entitled "Paradigm Shifts and Instructional Technology," I attempted to historically situate the emerging field of CSCL within the broader context of research on instructional technology. I approached this task using key concepts borrowed from the writings of T.S. Kuhn, particularly his seminal notion of a 'scientific paradigm.'

In this paper I will review that analysis, commenting critically on certain aspects that no longer ring quite true for me. I will then turn my attention to an assessment of CSCL specifically and evaluate its status as an emerging paradigm. Along the way, I will touch on each of the conference themes of reflection, convergence, collaboration, and innovation.

Kuhn's Notion of a Scientific Paradigm

The notion of a scientific paradigm is undoubtedly the most widely known and appropriated aspect of Kuhn's writings on the history and philosophy of science. The term 'scientific paradigm,' however, has been used in a variety of distinctly different senses.[1] It is sometimes used, for example, to refer to a research agenda that carries with it a shared set of beliefs about goals and methods. Others use it to refer to the community of researchers who pursue such an agenda.

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Following Kuhn (1972), I will use the term to denote a "scientific achievement," one that a "particular scientific community acknowledges for a time as supplying the foundations for its further practice" (p. 10). Used in this way, a particular experiment or research study must meet two conditions to qualify as a paradigm: First, it must be novel, that is it must be demonstratively different from those that came before. Kuhn wrote the paradigm must be "sufficiently unprecedented to attract an enduing group of adherents away from competing modes of scientific activity" (p. 10). Second, Kuhn specified that a paradigm must be "sufficiently open-ended to leave all sorts of problems for the redefined group of practitioners to resolve" (p. 10). These criteria of novelty and open-endedness will be useful to us when we examine actual "scientific achievements".

Why would we want to do a Kuhnian analysis of research in instructional technology? I can think of at least two reasons. First, it provides a means of rationalizing and lending order to the vast range of activities that fall under the title "instructional technology research". In the past, authors have attempted to categorize work in this area on the basis of functionality of the designed artifacts (e.g., Crook, 1994; O'Shea & Self, 1983; Taylor, 1980) or by the nature of the underlying theories of learning and instruction (e.g., Derry & LaJoie, 1993; Duffy & Jonassen, 1992). Categorizing work on the basis of actual research practices, as one does in a Kuhnian analysis, allows us to see connections that would not necessarily be seen if we studied the field in the more traditional ways. A second motivation for undertaking such an analysis, is that it provides an opportunity for reflection—reflection on where the field has been and where the field might be going. With that goal in mind let us now turn to the actual analysis published in 1996.

Reflection: Analyzing the Paradigms of IT

In the published chapter, I identified three existing paradigms in instructional technology (i.e., CAI, ITS, and Logo-as-Latin) still employed within instructional technology research and posited CSCL as a possible emergent paradigm. These are summarized in Table 1, which is reprinted from the original chapter. The table provides various attributes for each paradigm such as the event marking the emergence of the paradigm, its underlying theory of learning, its embedded model of instruction, the research issue or question to which the paradigm is addressed, and, finally, a list of references to paradigmatic studies. I will organize my comments around two particular issues. First, is the structure adopted in this analysis and reflected in the table the proper one for a Kuhnian analysis? And, second, is the content of the table, particularly the list of paradigms, accurate and complete?

With regard to the first question, I now suspect some of the attributes displayed for the named paradigms are at least confusing and, at worst, may be at odds with the strict form of Kuhnian analysis that I had in mind when I undertook the project. For example, the attribute 'theory of learning' is a bit confusing since, as we will see in a moment, a candidate study may have an *expressed* theory of learning which may be inconsistent with the theory of learning implicit to its method. The 'model of instruction' is similarly confusing since research representative of the type labeled here as "CAI" can be applied to the task of evaluating virtually any sort of method of instruction, so the method of instruction need not be an attribute of the paradigm. In sum, these matters might be germane to a paradigmatic analysis if we were treating a paradigm as a shared research agenda or a community of researchers. If we take a paradigm to be an actual "scientific achievement," however, they may be less relevant.

We might also raise questions about the choices of paradigms represented here. Are they formulated accurately and is the list complete? In the description for the CAI paradigm provided in the chapter, the impression is created that the paradigm was invented concurrent with the introduction of computers into classrooms. I now think that this is erroneous. CAI paradigm might be better understood as an the appropriation of a much older paradigm that serves as a foundation of practice in educational psychology and whose roots stretch back at least to the days of E.L. Thorndike and possibly earlier.[2] It is, therefore, simply an extension of a more general framework of study designed to evaluate any form of instructional innovation. It is this established tradition of use that partially accounts for the dominance of this paradigm in IT research. It is not difficult to find examples of CAI research (it is finding examples of IT research that is not based on a CAI paradigm that is sometimes difficult!).

	Event marking emergence of paradigm	Theory of Learning	Model of Instruction	Research Issue	Paradigmatic Studies
CAI	Introduction of Coursewriter I (1960)	behaviorist	programmed instruction/ instructional design	instructional efficacy	Coulsen et al. 1962; Gilman, 1967; Merrill et al., 1980; More & Ralph, 1992; Riding & Chambers, 1992
ITS	Carbonell's dissertation (1970)	Information Processing Theory	one-on-one tutorial, interactive	Instructional competence	VanLehn 1982; Clancey, 1983; Woolf & McDonald, 1984; Koedinger & Anderson, 1990
Logo-as-Latin	Publication of *Mindstorms* (1980)	cognitive constructivist	discovery-based learning	instructional transfer	Clements & Gullo, 1984; Lehrer & Littlefield, 1993; DeCorte et al., 1992; Verzoni & Swan, 1995
CSCL	NATO Workshop (1989)	socicocultural theories of learning	collaborative learning	instruction as enacted practice	Roschelle chapter; Glenn et al., 1995; Roth (in press)

Table 1: Some paradigms of research in instructional technology (reprinted from Koschmann (1996) with permission from Lawrence Erlbaum Associates)

The CAI paradigm has an implicit theory of learning that derives from the psychological tradition from which it arose. A study, therefore, might espouse a particular theory of learning (e.g., Vygotskian, situated, distributed cognition) and employ it in designing an instructional intervention. If it uses Thorndikean outcome measures to evaluate the intervention, however, it displays an allegiance to an entirely different theory of learning. There may be a conflict, as a result, between the *espoused* and the *applied* theory of learning.

I believe the ITS paradigm was accurately described in the original chapter. ITS research is concerned with machine emulation of skilled instruction. It involves the development of algorithms to represent pedagogical and domain knowledge and student understanding. The examples of ITS research cited clearly employ a methodological framework that is different from the CAI paradigm and that derives from work in Artificial Intelligence (AI).[3] The problems identified in these early papers (e.g., student modeling, instructional discourse management) are difficult ones that are still being investigated by AI researchers. ITS research, therefore, would seem to satisfy both of Kuhn's criteria for a paradigm shift.

I am less confident with regard to the Logo-as-Latin paradigm. Though Papert (1987) did argue for an alternative form of research in IT,[4] the research examples cited are not necessarily examples of the type of research that Papert was proposing. They are studies that focus on the question of whether or not learning to program in Logo and other languages leads to benefits in other domains (e.g., logical reasoning). Such forms of research, like the CAI paradigm, arise from an old tradition in educational psychology. It is so closely related to CAI research, in fact, that it might better be treated as a variant on the CAI paradigm rather than a distinctive paradigm in its own right.

When I completed the chapter, I indicated that I was not sure whether or not the list of paradigms was complete and I continue to have reservations in that regard. One possibility for a new inclusion, for example, would be the frequently cited methodology of "design experiments" (Brown, 1992). Whether or not research based on this notion satisfies Kuhn's criteria of novelty and open-endedness, however, is not a question I am prepared to answer at the moment. The fourth paradigm listed in the table, the CSCL paradigm, was really a proto-paradigm at the time that the chapter was written and we will take up its current status in the next section.

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Convergence: Antecedents of a Paradigm Shift

In the early and mid-1980s, there were a number of developments that set the stage for the emergence of the field of study we now know as CSCL.[5] All of these developments were oriented toward examining the affordances of technology in collaborative settings and all focused, at least initially, on instruction at the post-secondary level.

Some early preliminary work was devoted to the development of technologies to support learning at a distance. Notable among these efforts was the development of the so-called "Virtual Classroom" (Hiltz, 1988) by Roxanne Hiltz and Murray Turoff at the New Jersey Institute of Technology (NJIT) and the development of the CoSy program (Kaye, 1995) at the Open University in the U.K. These projects were, of course, precursors to what we now know as the "virtual university". Another early influence was the proliferation of computer-based programs to support teaching in composition, what Gruber, Bruce, and Peyton (1995) referred to as the "CSCWriting programs". These programs reflected a view of learning as joining an established community or discourse (Bruffee, 1993). One of the early workers in this area was Trent Batson in the ENFI project (Bruce, Peyton & Batson, 1993) at Gallaudet University. Focusing on student epistemologies and the development of skills for knowledge sharing, the CSILE program (Bereiter, 1997; Scardamalia & Bereiter, 1996) developed at the Ontario Institute for Studies in Education (OISE) at the University of Toronto by Carl Bereiter, Marlene Scardamalia, and their colleagues, became one of the most widely used and studied CSCL applications. Its influence stemmed in part from the fact that it was designed upon a very well-articulated theory of instruction (Bereiter, 2002). A fourth early influence was the 5th Dimension Project (Blanton & Cole, 1997; Kaptelinin & Cole, in press) developed by Mike Cole and other researchers at the Laboratory for Comparative Human Cognition (LCHC) at the University of California in San Diego. The 5th Dimension is an international multi-site network of after-school teaching programs initially developed as clinical training sites for pre-service teachers. The 5th Dimension Project was less technologically-oriented than the other early projects, but it made considerable contributions toward the development of a theoretical framework for studying learning from a sociocultural perspective (Newman, Griffin & Cole, 1989).

These influences began to converge in a series of meetings that took place around 1990.[6] A NATO-sponsored workshop on computer-supported collaborative learning was held in Maratea, Italy in 1989. A workshop with a similar theme was held at Southern Illinois University in the U.S. in 1991 (Koschmann, 1992) with sponsorship by Xerox PARC.[7] The first full-fledged CSCL conference was organized at Indiana University in the fall of 1995. Subsequent international meetings have taken place on a biennial basis, with conferences at the University of Toronto in 1997, Stanford University in 1999, and the University of Colorado in 2002. The first European conference on CSCL was held at the University of Maastricht in the Netherlands in 2001. In the period since the Maratea workshop, a number of edited collections specifically focusing on CSCL research have been published (Bonk & King, 1998; Dillenbourg, 1999; Koschmann, 1996; Koschmann, Hall & Miyake, 2002; Littleton & Light, 1999; O'Malley, 1995).

In the introductory chapter, I wrote "[CSCL] is built upon the research traditions of those disciplines—anthropology, sociology, linguistics, communication science—that are devoted to understanding language, culture, and other aspects of the social setting" (p. 11). As a result, it relies upon what I termed "socially oriented theories of learning" (p. 16) and I provided three examples, namely social constructivism, cultural-historical Activity Theory (CHAT), and situated learning (also known as social practice theory). This was not meant to be an exhaustive list, however, and I might now include neo-Piagetian conflict theory (Doise & Mugny, 1984), Bandura's theory of observational learning (Bandura, 1986), Bakhtinian dialogic theory (Koschmann, 1999b; Wertsch, 1998), and Distributed Cognition (Hutchins, 1994). As discussed earlier, however, the espousal of a new learning theory does not necessarily constitute a paradigm shift. To determine whether or not a shift in paradigm has occurred, one must examine actual instances of research.

Collaboration: Examining a Paradigm Case

One approach to studying paradigms would be to identify distinctive forms of research and then trace back through the research literature to find the original "paradigm" upon which the research was based. A diachronic analysis of this sort, however, is often difficult to do in practice. As we have seen with regard to the CAI paradigm and the ITS paradigm, the paradigm is not a new invention but is based instead on methods and tools appropriated from other contexts. What one tends to find then are chains of borrowed practices rather than the abrupt introduction of novel paradigms. It is still possible, however, to conduct paradigmatic analyses synchronically. By this approach, a search is made for examples of scientific achievement that can satisfy the Kuhnian criteria of novelty and open-endedness. If examples of such paradigm cases can be found, they serve as evidence of the existence of a new paradigm even though the actual paradigm cannot be identified.

The chapter written by Jeremy Roschelle (1996) and cited in Table 1, can serve as an example of a paradigm case for the latter type of analysis. In this chapter, Roschelle postulates that conceptual convergence "is achieved incrementally, interactively, and socially through collaborative participation in joint activity" (p. 211). He suggests, however, that this poses a puzzle. When one examines the interaction of learners engaged in such activities it is often unclear what is being accomplished through their discourse. Roschelle asks how is convergent change possible using "only figurative, ambiguous, and imprecise language and physical interactions" (p. 212)? He proceeds to demonstrate that this is not only possible, but does occur. He describes a longitudinal case study of two high school students (Carol and Dana) and their use of a graphical program that simulates the acceleration and velocity of Newtonian particles.

Roschelle conducted an analysis of interaction between the students over two one-hour sessions using the program. He reports in great detail on five particular exchanges within this period. For each exchange, he describes the "conversational action" capturing not only the lexical components, but also timing and prosodic features. For some of the episodes, he also describes gestural exchanges and the available representations produced by the simulation program. For each of the episodes he attempts to summarize the "conceptual change" evidenced in the exchange and the displayed "shared knowledge".

Instead of attending to *what* was learned using some sort of performance measurement, Roschelle's study focuses on *how* learners achieve new conceptual understandings in the presence of computational artifacts. Research of this type that attempts to document "thinking practices" (Goldman & Greeno, 1998) is decisively different from that that employs the CAI paradigm. Though some of Roschelle's terminology (e.g., shared knowledge, conceptual change) arises from cognitive science, his methods and research questions are distinctively different from those pursued in research employing the ITS paradigm. As a result, his project satisfies Kuhn's criterion of novelty. Also, I think there can be no doubt that Roschelle's study left behind an adequate supply of "problems for the redefined group of practitioners [i.e., CSCL researchers] to resolve" (Kuhn, 1972, p. 10). In the next section, I will take up some of these problems.

Innovation: The Need for Better Theories and Methods

Traditional theories of learning treat learning as a concealed and inferred process, something that "takes place inside the learner and only inside the learner" (Simon, 2001, p. 210). CSCL research has the advantage of studying learning in settings in which learning is observably and accountably embedded in collaborative activity. Our concern, therefore, is with the unfolding process of meaning-making within these settings, not so-called "learning outcomes". It is in this way that CSCL research represents a distinctive paradigm within IT. By this standard, a study that attempted to explicate how learners jointly accomplished some form of new learning would be a case of CSCL research, even if they were working in a setting that did not involve technological augmentation. On the other hand, a study that measured the effects of introducing some sort of CSCL application on learning (defined in traditional ways) would not.

In the two decades that have passed since the initial efforts to introduce technological artifacts into settings of learning and collaboration, however, we have yet to develop a consensus within the CSCL community with regard to what it means to learn and how to study the process. Many methodological questions also remain. What constitutes adequate documentation of learning? When describing practices of thinking and learning how much of the context must be included in order to make the practices meaningful? How is an analyst's account shaped by prior experience and how can this be reflexively displayed within an analysis? What are the limits of what can be viewed and described "in the moment"? How does one aggregate findings from purely descriptive studies? Answers to questions such as these must be found before research applying the CSCL paradigm will enter into a phase of "normal science".

I have found this exercise of revisiting my prior paradigmatic analysis of research in instructional technology to be a useful one. As a first attempt at doing such an analysis, the original chapter raised some interesting questions and stimulated much thinking about the actual practices of educational research. In looking at this analysis with fresh eyes, I can see many ways in which it could have been improved, but my commitment to the original project is undeterred. The original task is far from complete, even to the degree that such a task can ever be completed in such a large and ever-expanding body of work. Further examinations of research practice are needed as is an illumination of the theories that guide our work.

Endnotes

1. Kuhn was as guilty in this regard as anyone. Masterman (1970) listed 21 distinctive ways in which the term was used in *The Structure of Scientific Revolutions* and suggested that her listing was not exhaustive.
2. See Koschmann (2000) and Koschmann (2001) on the theoretical foundations of research methods in education.
3. This does not preclude testing ITS systems using the CAI paradigm and many examples of such research can be found.
4. He argued strenuously against what he termed the "treatment method of research" (p. 26) which is roughly the same as what is being described here as the CAI paradigm. The gist of his argument was that the effects of using computers in schools were multiple and that they could neither be studied in isolation nor be studied exhaustively.
5. The traditional expansion of CSCL is "Computer-Supported Collaborative Learning," but see Koschmann (1999a) for a discussion of other possible interpretations.
6. Well prior to this there had been a Workshop on Joint Problem Solving and Microcomputers (Cole, Miyake & Newman, 1983) at LCHC in 1983 that brought together researchers from the 5th Generation Project and educational researchers from Japan.
7. Attendees at the U.S. workshop came primarily from research centers in the U.S., but had connections to work going on elsewhere. Jeremy Roschelle and Denis Newman had both participated in the earlier European workshop and Newman had been one of the organizers for the 1983 workshop at LCHC.

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GETTING ONLINE: THE CHALLENGES FOR ACADEMIC STAFF AND INSTITUTIONAL LEADERS

SUMMARY PAPER

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Abstract

A number of factors have made the push for universities to move online both inevitable and urgent. The implications for teaching and learning are far reaching and include both opportunities for enhancing the quality of student learning and threats to the values underlying higher education. Maximising the opportunities and minimizing the threats of 'getting online' pose challenges for academic staff and institutional leaders alike. Academic staff have to change their roles and develop new skills and ways of working. Institutional leaders have to create a culture that encourages and supports these changes.

Keywords

conceptions of teaching and learning, institutional change, quality teaching and learning, professional development

Background

Universities around the world are moving rapidly to incorporate information and communication technologies (ITCs) into all aspects of their core business of teaching and learning (Bates, 2001; Ryan, Scott, Freeman & Patel, 2000). In Australia, as elsewhere, this interest in technology has been prompted by a number of factors, including:

- The spread of ICT into all aspects of economic and social life
- Demand from students for more flexibility in how they learn
- Competition from non-university players for the education market
- Enthusiasm of early adopters
- Possibility of cost savings by moving online.

Implications for Teaching and Learning

The move to exploring the possibilities which ICTs and in particular, the World Wide Web, offer to education has a number of implications for teaching and learning in higher education. A positive view of ICT is that it offers great opportunities to enhance the quality of learning by providing exciting and challenging learning environments and the opportunity for increased interaction and collaboration between learners (Chickering & Gamson, 1996; Herrington & Oliver, 2000).

A negative view is that ICT may undermine the values that underpin higher education in particular the role of the teacher as knowledge expert and the importance of the teacher-student relationship for effective learning (Gilroy, 2001; McCombs, 2000).

Opportunities

The opportunities that ICT presents for enhancing the quality of teaching and learning include:

- Providing encouragement for staff and students to reflect on how they teach and learn
- Applying theory and research on learning and the principles of good instruction to designing online learning environments
- Making teaching (and learning) more visible and public
- Encouraging collaboration and team work among staff (and students)
- Offering greater access to learning for more people
- Increasing the skills and status of university teachers.

Threats

The threats that ICT presents for undermining the values of higher education include:

- Reinforcing and entrenching a content-driven, transmissive approach to teaching and learning
- Depersonalising the teaching and learning experience
- Undermining the traditional role of university teacher as knowledge expert
- Presenting education as a commercial enterprise to the detriment of its social and intellectual goals
- Taking control of education out of the hands of academics
- Destroying what we really value about teaching and learning.

Challenges

Maximising the opportunities and minimizing the threats that ICT represents for higher education poses a number of challenges for both academic staff and institutional leaders (Bender & Gray, 1999; de la Harpe & Radloff, 2001; Entwistle, 1998; Jackson & Anagnostopoulos, 2001; Kember, 1998; Marton, Dall'Alba & Beaty, 1993; McLoughlin, 2000; Ryan, 2001; Salmon, 2000).

For academic staff, these include:

- Reflecting on, and if necessary, changing conceptions of teaching and learning
- Understanding the process of learning
- Focusing on the pedagogy, not the technology
- Developing new skills and ways of working
- Engaging in the scholarship of teaching and learning
- Being brave and bold.

For institutional leaders, these include:

- Developing a vision of what the enterprise of higher education should be
- Championing that vision and communicating it to all stakeholders
- Setting a realistic agenda for change
- Creating an environment in which change can happen
- Managing the change with skill and empathy
- Taking risks and (sometimes) going out on a limb.

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DESIGNING LEARNING ENVIRONMENTS THAT EXCITE SERIOUS PLAY

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Abstract

The phenomenon of play is proposed as a legitimate goal for interactive multimedia learning environments. Play offers a means for understanding motivation and learning in a holistic way. Serious play is not easy to achieve, but the reward is an intense and satisfying experience for both students and teachers. Technology offers many routes to serious play. Some are aligned with the design of interactive multimedia, such as simulations and games. Others are aligned with design activities where students themselves take charge of multimedia tools. Three collaborative projects are offered as examples of this proposal and the issues that frame it involving elementary and middle school students, graduate students, and students with intellectual and behavioral disabilities.

Keywords

play theory, interactive multimedia, learning environments

Introduction

I am interested in those times when a person chooses to devote tremendous effort and emotion to a task. Such intensity can be found in the activities that we usually associated with leisure. Think of your own hobbies. Undoubtedly, there are a few which come close to an avocation for you. Does this kind of activity and the learning that accompanies it ever take place in school? Sometimes, but not very often. A person's interest in school learning rarely compares to the commitment that characterizes their learning outside of school. As a researcher, I'm fascinated with the question of why this kind of learning is so rare in schools. As an educator, I yearn to replicate this kind of learning ferocity in the classroom. There is irony here, because it can be very difficult to arrange one's own learning environment in order to learn something new at a deep level. School has the resources, the time, and the expertise available to help a person. Yet something seems to happen to so many people when they walk across the threshold of school's door that thwarts such learning. Too bad, because when such commitment and passion is supported with resources and guidance, there is a rare opportunity for something wonderful to happen.

I have spent over 20 years as a teacher, first as an elementary school teacher and now as a member of a graduate faculty. I know firsthand how children enter school, taking in and learning about the world as easily as they take in each breath. School soon teaches them a different kind of learning, one where learning is regimented, homogeneous, and based more on rewards and threats than curiosity and interest. This is by no means an indictment of teachers. I am inspired by the great job done by many teachers given the constraints and expectations imposed upon them. At the university level, I continue to be surprised at how strongly conditioned so many adults remain to the school experience. In one curriculum reform effort I've been involved in at the university level that I'll explain more about at the end of this paper, we have tried to create a learning environment to give adults more autonomy, responsibility, and flexible choices for their learning. But a great many struggle with such choices and opportunities. It's a very new experience to them, even though the choices and responsibilities they face in their daily lives are much more complex. These experiences as a teacher, coupled with my own learning experiences, have slowly led me to some conclusions about learning in and out of school. In this paper, I focus on the relationship between learning and motivation. I see learning and motivation as inseparable and I have also come to view motivation as the more important of the two. Master teachers and the best designers understand motivation at a deep level and offer true respect for a person's motivation. Learning is not the only goal we educators should seek, but also passion for learning.

When I experience this kind of learning, it is very satisfying and enjoyable, despite being very hard work. For me, it usually comes from the act of tinkering while trying to build or write something. I have struggled over the years to define this kind of learning, but have settled on one simple word to describe it — play. There is nothing special to this claim as play continues to be an important research topic in fields such as psychology (Csikszentmihalyi, 1990; Pellegrini, 1995) and anthropology (Blanchard, 1995). Play is usually associated with children, but despite all of the differences between adults and children, play is a suitable and respectable way to describe intense and meaningful adult learning (Kerr & Apter, 1991). I urge you to resist the tendency to recoil at the sound of the word play to describe your own learning. For instructional technologists, play offers a way to understand the complexity of interactivity of children and adults within educational multimedia. Given computer technology's ever increasing affordances for interactive and social learning, such understanding is essential. Seymour Papert (1993) has described the computer as "the children's machine" due to the way children have so easily acclimated digital technology into their lives. If we as adults want to do the same, we would do well to follow a child's example. As adults, we usually want our children to be more like us, but perhaps in the end, if we want to capitalize on technology's benefits for learning and performance, we may need to be more like them. I believe the phenomenon of play offers the best chance we have for both understanding and realizing the interplay between motivation, learning, and technology.

The purpose of this paper is to call for designers and teachers to use play as an important benchmark for evaluating the learning environments they create or use. Such a call squarely puts motivational outcomes on an equal standing as cognitive ones. It is not enough just to suggest that learning and performance have been demonstrated, but also that students are emotional and passionate when it comes to their learning. This creates a lasting feeling of commitment and ownership. Learning without emotional ties are short-term and temporary. The construct of play is our best candidate for wedding cognition and motivation within learning environments.

I will use the title of this paper to explain my position and to argue that serious play needs to be a fundamental goal for instructional technology, followed by giving a few examples of how my colleagues and I have tried to put these ideas into practice.

Designing: Thoughtful Exercises in Exclusion

Design implies a planned intervention to a solve a problem, fill a need, or realize an opportunity. Unlike art, design has purpose and parameters. Consider the design of something as simple as a doorknob. One cannot create a doorknob without attention to the physiology of the human hand due to the design limits associated with the acts of grasping, turning, pulling, and pushing. Other design limits are imposed by the diversity of human physical characteristics, such that some people are not able to walk or have other limited use of their limbs. A doorknob may have aesthetic elements, but to be used by people everyday, it cannot be art because it cannot ignore the purpose and parameters that art is allowed to follow. For any design, the decision as to what is left out is much more important than what stays. Most designs are thoughtful exercises in exclusion. Of all the possibilities, most are discarded. Unfortunately, the audience suited to the resulting designs will likewise be narrowed. Attempts to change this are mounting, as in the call for *Universal Design* (Rose & Meyer, 2000), a movement begun in architecture to allow access and free movement by all people, no matter their disability and now championed by special educators to require all educational computer software to meet individual differences among people with disabilities. At first glance, the issues seem simple and straightforward, such as providing text descriptions of all graphics posted on the Internet so that people with visual impairments can access their information. However, as the call for Universal Design in learning environments mounts to give people with other disabilities access to all resources, especially cognitive and behavioral impairments, the issues become surprisingly complex quickly with design solutions impenetrable, leaving designers stymied and frustrated. After all, if Universal Design were possible, we would have a 100% literacy rate.

For most educators, the most prominent example of design is instruction. The role of instruction in learning has led to some tumultuous debates over the last 15 years or so. There have been camps defined on the question of what are the best routes to learning and whether instruction should continue as the dominant path in education. I recall a short debate on the ITFORUM listserv (online) a few years ago debating whether Broderbund's *Living Books* series should be considered instruction. Even the most diehards of instructivists agreed these CDs were wonderful portals for learning and acquiring a love of reading. Is a Living Book instruction? My response was that the question itself was uninteresting. Better questions to ask relate to how learning and passion for storytelling are afforded by their creative designs, or whether such e-Books risk replacing one of the most instructive strategies of all, that of a mother or father reading a book to their young child.

Such debates have taken place due to the rise of a constructivist paradigm in education. Of all the definitions and interpretations offered for constructivism, I prefer epistemological ones that focus on meaning or what it means "to know" something. I am quick to retreat to my Piagetian roots when the constructivist rhetoric starts to confuse or frustrate me. I consider myself a constructivist in that my focus is on a person's learning and "meaning making". But I prefer to call myself a pragmatic and eclectic constructivist because I try to remain open to all ways that will enable learning and resist rigidly aligning any learning approach to just one philosophy. Consequently, I see a role for instruction in learning. Instruction can be a very powerful means to enabling learning. Although there are those constructivists that question any use of preplanned instruction, only the most radical would question the need for a more capable other to help, even intervene, on behalf of another *at just the right moment* and in *just the right way* during learning. Of course, knowing the "right way" and "right moment" is very difficult. That is why the idea of considering the teacher as the facilitator or manager of learning elevates the importance of the teacher. Guiding, shaping, and managing the learning experience is far more demanding than that of dispensing information. It is far more satisfying as well.

Notice that I used the verb "designing" in my title instead of the noun "design". I do so because I do not see design as a completed act waiting to implemented, but as an evolving process that continues as long as a person is learning. Design continues long after the web page has been uploaded or the CD has been burned. At most, one designer passes the design effort onto another, whether they be teachers or the learners themselves. If a web site or CD-ROM has been designed well, it is flexible enough to allow the next designer to use it in interesting ways, especially ways that were not anticipated.

Learning Environments: Maintaining a Delicate Balance

The phrase "learning environment" is one of the most often used in our field. It is used so much that I'm afraid that it has lost much of its meaning. I'll offer a definition. A learning environment is a space where the resources, time, and reasons are available to a group of people to nurture, support, and value their learning of a limited set of information and ideas. Learning environments are social places even when only one person can be found there. The center of a learning environment is sharp, clear, and focused, but the edges are very fuzzy. There are limits to each learning environment, both in what can be learned there and whose learning will be supported most. It is most common to describe a learning environment by the types of resources to be found there, but while the resources are crucial to a learning environment's effectiveness, resources are only as good as the conditions under which one has access to them.

I've used the phrase "learning environment" a great deal in my writing. I'm fond of it because it conjures up images for me of diverse ecosystems in nature. I've had the pleasure of living in three distinct areas of the United States — the northeast, the southwest, and now the southeast. My many long drives during all times of the year between the northeast, where my parents continue to live, and the southwest and southeast have given me a perspective on the diversity of America's animals, plants, geography, and geology. The differences are striking because the respective environments support and nurture a definite style of life. The diversity of resources and how a plant or animal gains access to those resources is a delicate balance. Interventions, such as dams, clearing forests for farming and houses, shift the balance and the equity. Likewise, learning environments are places where diverse people have different access to limited resources. The goal, of course, is to provide a person all the resources he or she needs in a suitable climate for learning. But we know this is never possible. The complexity of human learning makes even the identification of which resources are appropriate for which people very difficult. One of the most precious resources for learning — time — is usually in short supply. Time spent to comply with the expectation to "cover the curriculum" seems misplaced to me. I have come to value less scope and more depth when it comes to learning. A curriculum is a marvelous aid to learning and teaching, yet it all too often becomes a ball and chain for even the most able and well-intentioned teachers.

Excite: Getting Emotional About Learning

This was the most difficult word to select and its choice took the most time. This word signifies the action arising from our designs, or at least the opportunities for action. Before explaining my choice, you should know that I had many other candidates. But each fell short in many ways. Words like "trigger" or "instantiate" came to mind early, but these imply cause and effect, thus negating the role of choice. "Afford" would have been a good choice because it speaks of certain opportunities made possible by a design while also making it clear that other opportunities are necessarily neglected. Yet, the word carries no emotion which I believe is so vital here. The word "provoke" was actually the runner-up. It conveys the idea of a learning environment so compelling that it actually "dares" a learner not to be interested. Unfortunately, the word also includes feelings of anger.

The definition for "excite" includes the following: "to call to activity; to rouse to feeling usually by a profound moving; to arouse as an emotional response by appropriate stimuli". The kind of learning I'm interested in is emotional, so emotional that one chooses to take action. The call to activity is one based on the human need to satisfy curiosity and to meet a challenge. The marvelous list of similar words that my thesaurus gave me for excite clinched it as my choice: arouse, inspire, animate, move, electrify, charge, thrill, awaken, and energize. All of these aptly capture the type of learning event I hope to convey. I am likewise confident that each of us can list specific learning episodes in our own lives that these words ably describe. There is also a connection to science with this word which provides a wonderful metaphor: "to raise an atom to a higher energy level". I would like to see learning also raised to a "higher energy level".

Serious Play: Elusive, But Always Ready to Emerge

I have been proposing in this paper that play be a goal for the learning environments we create and use. But what is play? Play is an ambiguous phenomenon, as the noted play psychologist Brian Sutton-Smith (1997, p. 1) points out:

> We all play occasionally, and we all know what playing feels like. But when it comes to making theoretical statements about what play is, we fall into silliness. There is little agreement among us, and much ambiguity.

Play can seem so straightforward and simple until one takes the time to try to understand it. Does play serve a purpose? If so, how and for whom? Do adults play? If not, then when does play stop? What is it then that adults do on the golf course, on the tennis court, in the garden, or in the workshop? Is recreation play? If not, then why not and what is it? Is play a diversion, an opportunity to rehearse something in a safe and protected environment, or something else entirely? I warn anyone who takes a peek behind the curtain of play that a confusing world awaits. (See Rieber (1996) for a detailed discussion of the characteristics of play).

I use the phrase "serious play" to try to distinguish it from the typical trivial ways adults use the word play. I like the oxymoronic sound to this phrase — it sounds contradictory. Play sounds fun and even frivolous, but never serious. But I use the term serious play to draw attention to the fact that I'm interested in play that has a purpose, though a purpose equally negotiated between learner and teacher. It also conveys a certain amount of respect for play in learning for both children and adults. This mirrors not only the theory and history behind play, but also its application in education. A simple way of understanding serious play in education is with the advice of "experience first, explain later." A teacher who follows this advice looks for ways to engage learners in some meaningful experience as early on as possible and the uses this experience as an anchor for later instruction. This advice is also consistent with some of the instructional design literature, such as concept of the epitome from Elaboration Theory (Reigeluth & Stein, 1983). Experience is an essential anchor for understanding the formalisms that are typically tested. An explanation of the physics underlying the motion of a basketball can only be understood well by having many opportunities to witness and study the event.

The strong form of my argument is that play serves a cognitive or educative purpose. This is but one aspect of play that has been examined over the years, known as "play as progress". There are many other perspectives to play, such as "play as power" (competitive aspects associated with sporting events) and "play as self" (play for play's sake as an optimal life experience). The history of play research has cycled between assumed benefits of play for learning, socialization, and developmental adaptation (the "play ethos") and serious skepticism about any benefits to play. The most current play theorists are quite cautious when it comes to causal benefits to play, and instead focus on indirect relationships. Learning and other benefits are believed related to play, but such outcomes are thought to be directly attributed to factors such as increased motivation. Despite the long history of play research, there is little research available that directly examines the relationship between play behavior, learning, motivation, and the affordances of existing educational technologies. Frankly, I find it compelling enough an argument to pursue play research in educational technology even if the only justification for play is that it creates the context and climate for a love of learning and creative expression in a particular domain. If play gets a person to the bridge of learning and convinces them to walk half-way across, then I hope that our instructional designs are robust enough to support them the rest of the way over. However, I will not be surprised if we find there is a lot more to it than that.

Serious play is relevant to the many approaches to interactive learning. Constructivists point to the use of microworlds and learning by building, using powerful tools such as Geometer's Sketchpad (Olive, 1998), SimCalc (Roschelle, Kaput & Stroup, 2000), ThinkerTools (White, 1993), and StarLogo (Resnick, 1991). I believe these ideas co-exist well with interactive multimedia based on simulations and games. Indeed, simulations seem to be the great common ground for designers with varying philosophical perspectives on learning and motivation. In a recent special issue of *Educational Technology* (2001, Volume 41, Issue 1) edited by Ward Cates, a group of designers were all given the same educational problem. All used simulations as some meaningful part of their designs even though they had very different philosophical points of view. In a field so fond of design principles such as ours, I've suggested a simple design principle for play: "Look for ways to trigger or coax play behavior in people and then nurture or cultivate it once it begins, just as one looks for a way to light a candle followed by both protecting and feeding the flame" (Rieber, Smith & Noah, 1998, p. 33). I think this a reasonable goal for designers of learning environments.

The Practice of Serious Play

I end this paper by describing a few of my most current projects as examples of my best efforts, in collaboration with many others, to practice these ideas.

The Studio Experience

Faculty in the Department of Instructional Technology at the University of Georgia had a unique opportunity in 1998. The University System of Georgia converted from 10-week quarters to 16-week semesters. All departments were encouraged to use this opportunity to reconceptualize their curricula. Our department did so in many ways. One notable effort of which I was a part was the redesign of our educational multimedia courses to resemble studio approaches most commonly found in schools of art and architecture. There is little space here to detail the studio experience for you, so those interested in the details are encouraged to visit our web site (online) and especially to download and read our Studio Handbook (Rieber, Orey & King, 2001).

In the studio, we tried to capture the experience of artist working long hours working creatively in a communal studio to build works that stand up to public scrutiny. There are many differences between our multimedia studio and an art studio however. The difference between art and design, discussed earlier, is a prime example. The collaborative nature of multimedia design is another example. In the studio, we deliberately have tried to enable mentorship between the more and less experienced students. We have also tried to walk a balance between giving our students the flexibility to choose different learning paths and tools to realize those paths. We have students interested in classroom teaching, corporate training, and constructionism. The ability of the studio instructors to support all of the possible choices is strained and imperfect. Yet, despite the weaknesses, we feel it is a better model than those which impose particular paths and particular tools to learn. Fortunately, the best projects coming out of the studio are a result of students who have thrived with this flexibility. We continue to search for ways to support students who need more guidance and more direction. Our most effective strategy so far has been to help students understand the skills associated with self-directed learning and to free them from excessive evaluation at the beginning of their studio experience. Instead, we ask them to focus on the general nature of design and to be reflective of their designs.

A project closely related to the Studio experience is "The Best Archive", a multi-university partnership dedicated to the archival of the best educational multimedia development work of graduate students (online). The partnership currently involves the University of Georgia, the University of Minnesota, Virginia Tech, and Texas A&M University. We feel it is waste of talent and resources to allow the very best projects done by graduate students to sit on shelves or back-up disks after a course or degree program has been completed. Recognizing student work in this way is satisfying for both studio instructors and students alike and is a much more authentic recognition than a grade. Even more important is the potential for the project to make a difference in other people's learning worldwide.

Project KIDDESIGNER

For almost a decade I and many of my graduate students have spent time with elementary and middle school students designing and developing educational computer games (online). It's been a marvelous experience for us and them. My motivation for starting the project was based on a simple question: Would children be able to take advantage of the opportunity to engage in game design when properly supported to do so? Unlike other well known projects (e.g. Kafai, 1995), we focused more on the design process and less on the goal of children-learning-programming. The children designed the games' goals, rules, characters, and graphics. The adults put it all together according to the children's plan as their plan evolved. We used a rapid prototyping methodology where early but crude, working prototypes were quickly delivered back to the children so they could evaluate and modify their designs by seeing the working examples. The children we worked with easily met the challenges we gave them. We believe they were able to do so for several reasons. First, games are a part of their culture: they are expert game players and game designers.

We were merely asking them to do something in school they do extremely well outside of school. Second, because games, and especially computer games, are a part of their culture, they found the task of game design very authentic. We gave them the task of designing *educational* games, which they perceived as a good use of their time in school. They devoted great amounts of time and effort to their group projects. After all, they owned the games. Finally, we did not impose the same tasks on all the children. They were free to form design teams and team members were expected to take on jobs that suited their skills and interest. We had no problem finding children to play the roles of project manager, subject matter experts, graphic designers, and lead game designers. This is not to say we the adults did no work. Besides doing the programming, we facilitated their work sessions, their brainstorming, and their discussions of making priorities and selecting tasks. They welcomed this advice because they knew they weren't good at it. But, we never told them that we thought some ideas were bad and some were good. Indeed, we quickly gained their confidence after bringing back to them the first working prototype. They found out that this group of adults were a little different — these adults actually listened and apparently took great time and pains to bring them back something that only a few days before were sketchy ideas.

Project KIDDESIGNER has made me believe that a school's curriculum should be based on design activities. I envision the creation of innovative schools that use "learning by designing" as their basic philosophy. I think of these as Juilliard schools of design, so to speak, but not a school reserved for a few because I believe these design talents exist in every child. School should be a place that matters today for children, not merely a place to prepare them for tomorrow. We also need to rethink school as a place where "one size fits all", instead allowing children to develop their own focus and depth. Games are but one type of a design activity, though one with which I have had much success. Such a school would have the following characteristics:

- Work is done largely in design teams in a studio environment.
- Students learn using an apprenticeship model with skill learning embedded in practice.
- Expertise is distributed within the design team.
- The best teams consist of a diversity of people (including diversity of age) and a diversity of knowledge; individuals develop their own expertise areas.
- Students learn how to critically analyze their work and the work of others.
- Learning is achieved through a variety of strategies, with instruction being just one.
- The "basics" are learned through their need and application within authentic projects.
- Not everyone learns the same thing.

Such a school would have an economic, not academic rationale, mirroring what is currently happening in the workplace where the focus is on certificates of expertise, not general diplomas. Students would learn the power of interdisciplinary problem-finding and problem-solving, collaboration, communication, persuasion, argument, and marketing. Such a model would combine business and the arts and sciences. (Such skills are already becoming the basis for e-Commerce.) Education based on design activities is consistent with the information age. In contrast, today's schools are still based on industrial-age attitudes where many fail, a few flourish, and the rest are happy to survive.

Project Shop

The final project I briefly describe here is one of the most satisfying and challenging projects with which I have ever been associated. Project Shop is funded by the U.S. Department of Education to produce educational multimedia for children with special needs, specifically mild to moderate cognitive and behavioral impairments. John Langone, Tom Clees, both on the faculty in the Department of Special Education, and myself are the Project Directors. The goal of the project is to produce stand-alone video and an interactive CD-ROM to support these children as they acquire the literacy and social skills necessary to successfully complete a shopping trip at a supermarket. The design challenge is conversely related to the apparent simplicity of the task. After all, we "normals" take for granted something as mundane as a trip to the grocery store. Yet, the grocery store is a complex place for item discrimination and identification, social interaction, and basic literacy (Morse, Schuster & Sandknop, 1996). My interest in this project is largely due to being the parent of a young man with very special needs. My son Thomas is diagnosed with pervasive developmental disorder, resulting in a significant behavioral disorder and challenges to learning and language processing.

The design challenges are too numerous to describe well here, but a few of the principles we have followed are worth mentioning. We are using a "no ceilings, no floors" philosophy, a phrase first coined by those at Vanderbilt University to describe activities that even the most and least challenged can access and enjoy. This philosophy was very evident in the video production. Despite my son's many disabilities, he is a sophisticated television and film consumer. The movies he likes the most are clever and intelligent movies, such as the *Back to the Future* series, most of the Ernest movies, Ghostbusters, and many musicals (*Grease*, *Oliver*, and *Annie* are among his favorites). Interestingly, the movies he likes to watch repeatedly are also ones that other adults that work with Thomas enjoy seeing repeatedly too. He is very partial to certain actors, most notably Robin Williams, Jim Carey, Nicholas Cage, Al Pacino, Bill Murray, and Whoopi Goldberg. When we started the planning for the video, we knew it had to have high energy with a level of sophistication and wit that could evoke the feeling of "I'm worth watching". We were most fortunate to work with a professional production firm out of Atlanta called ASV, Inc., headed by a marvelously talented father and son — Alan and Aaron Stecker. The Steckers took the lead in writing a very creative script and, despite a very limited budget, were able to produce an exceptional video (thanks in part also to the exceptional abilities of our project manager, Michael Matzko). The video features two pairs of roommates — Robbie and Brad, and Liz and Rachel — as they share adventures in a local supermarket. Robbie and Liz play characters with cognitive disabilities who show their respective roommates the right way to do things. The video also features Shopper Bob, a "wizard in training", who helps the foursome from time to time (as he attempts to earn his wizard's license) and also narrates the video for the audience. Shopper Bob was played by Tom Clark and was the only professional actor in the entire video. Like Robin Williams, he has a certain comedic energy on the screen which is very hard to ignore. The "normal" roommates provide other comedic opportunities because they are deliberately portrayed as somewhat bumbling and out of touch. We felt it was important to cast the people with disabilities as mentors in order to provide good role models for the children who watch the video. In many ways, it is a very provocative video, both in terms of how it portrays the roommates and its use of a wizard with magical abilities. Of course, we tried not to offend anyone or their beliefs, but we also were not afraid to capitalize on the same cinematic energy and sophistication that Hollywood uses to great effect.

Closing

The Studio, Project KIDDESIGNER, and Project Shop all are based on meaningful experiences to situate learning in authentic ways for the respective learners. Each involve learning environments that give considerable authority and responsibility to the learners with expectations of resources and management on the part of the teachers. The route that the learners take in each case is a demanding one, requiring hard work and commitment. The reward is an intense and satisfying experience that is best described as play. It's an elusive goal, yet one worth the trouble and challenges. I'm hopeful that school can be a place where people with diverse talents and interests can all find a niche. Historically, school has been a place to sort people, a place to figure out who would be the supervisors and managers and who would be the workers and laborers. The goals of education today are much different than they were even 25 years ago. It is clear that expecting everyone to learn the same thing, in the same way, at the same time is not supported by anything we know about learning and cognition. We know how to teach, how to learn, how to play, but we don't know how to manage school's resources — people, curricula, technology, time, etc. — to capitalize on the diversity of our students to bring out their natural learning abilities. Technology and play is a worthwhile combination to bet on in the years ahead.

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Special Report

2000 NextED research grant recipient

Vitartas, P., Sloan, K., Poh, P., & Dunlop M. (2001). (short paper)
An assessment of cross-cultural and social network influences on the delivery of an international teaching model utilising a computer-mediated approach.

PROGRESS REPORT
2000 NextED RESEARCH GRANT RECIPIENT

AN ASSESSMENT OF CROSS-CULTURAL AND SOCIAL NETWORK INFLUENCES ON THE DELIVERY OF AN INTERNATIONAL TEACHING MODEL UTILISING A COMPUTER-MEDIATED APPROACH

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Abstract

This paper provides a progress report and details of research being undertaken following the awarding of the 2000 NextED/ASCILITE research grant. The project is investigating cross-cultural issues in teaching an online program across three cultures: Australia, Singapore and Sweden. In addition the research is investigating the importance of social networks among students and how such networks differ by culture. The paper provides details on the background to the research and work undertaken to date. The final section presents details for the continuation of the research into 2002.

Keywords

cross cultural teaching, social networks, computer-mediated communication, online learning

Background to the Project

In 1998 a partnership was developed between the School of Commerce and Management at Southern Cross University and the Singapore Institute of Purchasing and Materials Management (SIPMM) for the articulation of their diploma and advanced diploma awards into a Southern Cross Bachelor of Business Administration award. The program was unique in that it was developed to allow students to interact with the presented material utilising a computer-mediated environment. Subsequently a similar agreement has been negotiated with "Silf Competence" (SILF), Sweden's Purchasing and Logistics Association, for the development of a similar program to be delivered in Scandinavia. Furthermore, the Australian College of Warehousing (ACW) has recently entered into an articulation agreement with the School and the program will be offered to students from the ACW in 2001.

The current program involves ten Southern Cross University units being delivered online via Course-Info (from Blackboard.com). A total of 193 students have already undertaken the program from Singapore and the forecast student numbers are expected to double with the recent SILF and ACW agreements. Undertaking such a program raises a number of issues not normally faced in the traditional teaching environment. For instance, there may be cross-cultural issues and problems in teaching online students with different language and cultural backgrounds. In addition offering the program online also adds to the dimensions that need to be managed in the program. In an attempt to find solutions to some of these issues the researchers explored the literature in the field of cross-cultural computer-mediated instruction.

Cross-cultural computer-mediated instruction is a rapidly growing phenomenon, (Davis, 1998) and although in its infancy in Australia, is emerging as a key issue for educators (Gibbons, 2000). A number of instructors have experimented with courses that encourage their students to interact with colleagues in another country (eg. Lebaron & Pulkkinen, 2000; Sallis & Bygrave, 2000; Jager & Collis, 2000). However, for educational institutions involved in the delivery of programs across borders, understanding and researching the nature of learning and the influences of cultural settings is considered essential in an effort to develop and improve the delivery of cross-border programs (Stone, 1986). While the Internet makes it possible to deliver programs efficiently and effectively on a global basis there was a paucity of research reported in the area. Two notable exceptions were Chin, Chang, and Bauer, (2000) and Collis and Remmers, (1997). With the Australian education market rapidly expanding into the Asian arena, an understanding of cross-cultural issues in the use of computer-mediated education was considered critical for the success of an emerging industry.

Social Networks

When students congregate in a common learning environment, social networks are often established between individuals. Such relationships have been described as important features of life (Milardo, 1988). Differences in social networks between cultures have been reported (eg. Kim & McKenry, 1998; Julian & McKenry, 1994), however a review of the literature on the study of social networks within the learning environment revealed only studies which focused on family relationships and primary school students. No studies were reported at the tertiary level which examined social networks and students participating in computer-mediated courses. This suggests that there may be valuable opportunities for research in this area. The outcome of the literature searches revealed that minimal research has been undertaken to investigate the issues associated with utilising a computer-mediated approach across different cultures or social networks among students utilising a computer-mediated learning approach. As a result a project was developed to investigate these issues and was awarded the 2000 NextEd/ASCILITE research grant.

Project Aims

The project aims include:

- Investigate and contrast the learning experiences of students across three cultures,
- Examine the extent and types of social networks developed by student cohorts and the impact these have on participation in the computer-mediated environment,
- Document the influences of cultural differences on students' learning and participation in the computer mediated courses.

The project is significant in that it should contribute to an understanding of cross-cultural and social network issues in the design and delivery of computer-mediated programs. Educators should be able to use the information to assist in the development and implementation of programs for delivery across 'cultural borders'. An understanding of the importance and structure of social networks in disseminating information within the learning environment will also impact on the development and implementation of programs.

Progress

A literature search has been examined two areas. The first area examines cross-cultural issues in teaching. The majority of the work in this area, particularly in Australia, has focused on research that has been undertaken on foreign students studying in another culture, such as Australia (Anderson, 2001; Chin et. al., 2000; Conlan, 1996; Tan & Goh, 1999). However little published material has been found on the delivery of programs into other cultures, such as Australian courses being offered in Asia (although a scan of Asian newspapers will identify many Universities offering courses to students in Asia).

A second body of literature has investigated the use of Social Networks (Scott, 1991). The literature in this area is focussed on the use of 'social network analysis' as a means of studying interactions between people. To date no literature has emerged which has specifically examined the topic of social networks in tertiary education, although substantial material has been published on the use of social networks in computer-mediated environments (eg. Garton, Haythornthwaite & Wellman, 1997). The work in these two areas continues and will provide the basis for a number of hypotheses that can be tested in future research.

In addition to the literature review a focus group has been conducted with a group of Singapore students to identify the issues they face when choosing a course from another culture and to obtain an idea of the nature and extent of social networks being used within the courses. At the time of writing final results from this investigation are not available, however the following comments are provided as a general observation on the focus group transcripts.

In general, the Singapore students showed considerable motivation to better themselves. The culture has a strong educational value and all students mentioned that they were doing the study to better themselves so that they can be promoted in their jobs, or obtain better jobs. They use groups as a means of discussing assignments in an organised manner. Several mentioned their groups met regularly, often in social surroundings and on the weekend. During these sessions they would talk about assignments, how they would go about approaching the questions and share information. This may mean splitting tasks and assigning tasks to individuals for their work. They would also have someone act as editor and review their work. Email or telephone were the normal means of contacting and maintaining contact within the group. Some of the respondents also mentioned that their groups had difficulty meeting, because of distance or time commitments such as work and family. In these situations the group would continue without the members and then email information to members who couldn't attend the sessions.

Groups were developed early in the course and students tended to remain in their group as they progressed through the course. The nature of the particular program is that students in a particular intake develop strong allegiances to their intake group. They also had very little choice in the units they were taking as the progression from unit-to-unit was pre-determined and resulted in students staying together as a group. This means that students get to know each other, however it can also mean that students who have to join the intake late can find it difficult to break into a study group, or be accepted by the intake group. Study groups were developed early in the course and assigned by the instructor. Students groups were used so they could undertake assignments or activities together. A number of students mentioned that groups are common in adult learning classes across Singapore and also in workplace training programs. Other students gave instances where groups had been used in the school situation, so it is not specific to adult education only.

The focus groups confirmed the strong links between members in a course to assist in the completion of assignments. The groups were also formed to save time and to provide a sense of security that the students were progressing along the right track. It was also identified from the focus groups that the study groups were used as social networks and were more than just a means of study - it appears that the social network may emerge as a result of the groups early in course. These findings support the investigation of networks among students and when comparing the findings from the Singapore students with Australian students would suggest there are differences in the way networks are used between groups in these two cultures.

Future Plans

The literature searches and preliminary focus group undertaken have provided confirmation of the importance for this research and revealed that a great deal can be learned from the investigation of social networks across different cultures. While the literature search will continue, the next stage in the project is to develop a social network questionnaire and administer it to students undertaking the course. At the same time it is expected that qualitative data can be collected from students studying in Sweden. Following the analysis of the social network studies it is expected that the researchers will be able to develop recommendations for the improved use and design of online courses incorporating computer-mediated communication.

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Proceedings

(The Proceedings are arranged alphabetically by the name of the first author on the paper.)

ON BEING 'HEAD' – REFLECTIONS ON LEADING AN EDUCATIONAL INNOVATION INVOLVING COMPUTER TECHNOLOGY

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Abstract
The demand for innovative educational development is also a demand for new approaches to leadership in higher education. The assumption that the adoption of an institutional policy that encourages the use of learning technologies is all that is necessary for the successful implementation of the policy, obscures the role of middle level leadership. During the late 1990s the University of Wollongong began preparing to offer several degrees at regional centres by flexible delivery methods. I explore the B.A. development project in a heuristic way, using two models from the literature on leadership for change in both corporate and university settings to explain first what we had to do to be successful and then, what I as the leader did to enable that success.

Keywords
leadership, flexible delivery, educational innovation

Introduction

This is a story about both an individual and about a group of academics and academic support staff at the University of Wollongong who developed a B.A. degree to be delivered to three off-campus locations by 'flexible delivery'. I was the Head of the South Coast Project (Arts) and together with a number of younger academics and members of three academic and student support units have successfully developed and delivered two years of the program and will be offering the planned third year and a few additional electives in 2002. As a result of the August 2001 announcement of extra university places in regional Australia the degree will also be offered in the inland centre of Moss Vale in 2002.

I reflect on the role of Head and the experience of leading a project that demanded the integration of learning technologies into humanities and social science teaching, encouraged the integration of students at four sites in the teaching of individual subjects, required the teamwork among people working in an individualistic faculty culture (Albury, Lefoe, Littler, & Trivett, 2001) and challenged conventional notions about teaching and learning (Curtis, Lefoe, Merten, Milne, & Albury, 1999). I will explore the project in a heuristic way, using two models from the literature on leadership for change in both corporate and university settings to explain first what we had to do to be successful and then, what I as the leader did to enable that success. Some of the explanation is specific to the Faculty of Arts at the University of Wollongong between 1998 and 2000, but the general approach may be applicable to other innovative projects.

Meeting the Demand for Innovation

Today almost all academic innovation is driven as much by external demand as by personal or group initiative. The project was funded by the Federal government to improve access to higher education in rural areas through the use of the latest developments in technology. A submission by the University of Wollongong to the Commonwealth/State Working Party on Higher Education suggested that higher education in the region would be best provided through provision of a campus in Nowra (Shoalhaven) with smaller satellite centres further south. Teaching and learning would be supported through technology including: videoconference and computer-facilitated learning environments, as well as local tutor support (University of Wollongong, 1996). Three new centres at Nowra, Batemans Bay and Bega form part of the South Coast Education Network (SCEN), a partnership initiative between the University of Wollongong, Illawarra Institute of Technology (TAFE), the Department of School Education and local government bodies.

Although the region is referred to as the South Coast, the localities of the three education access centres are quite different. Early consultation with local government and local businesses identified several common themes for the subjects to be included in an Arts degree. Social and environmental policy, cultural heritage including Aboriginal studies, literature and history, and communications studies, became the framework for the degree that is now called B.A. (Community and Environment). In addition, the consultation identified the need for transferable skills including research, presentation and policy analysis to be central to the degree offerings. There was no articulated demand for preparation for entry to teaching via a Dip. Ed. then, so we are playing catch-up to introduce enough subjects to meet current student demand.

The South Coast Project (Arts)

Members of the Faculty of Arts had to learn new ways of working in order to develop and deliver an interdisciplinary specialisation of the B.A. Until 1998, when the subjects were chosen and the work began to produce flexible delivery versions, no one in the Arts Faculty had constructed an undergraduate degree specialisation that was not firmly based in single humanities or social science disciplines. While this is explicable in terms of the ways that academic disciplines maintain their boundaries (Becher, 1989), it made it difficult for most of the designated subject developers to envision a different way of working. For the most part, the lecturers with the responsibility for developing the subjects for flexible delivery had little knowledge of the teaching goals of other disciplines, yet they would have to build on the skills taught by others. In addition, only a few had used any of the proposed flexible delivery methods.

The financial constraints were equally challenging, the degree was to be constructed mainly of existing subjects, with two exceptions that were similar to subjects offered at Wollongong. The intention was that the application of novel teaching methods would be available for students enrolled in subjects on the Wollongong Campus as well as for the small number of students in the new centres through the conversion of existing subjects. The relatively small amounts of money available to support curriculum innovation were for staff development on the Wollongong Campus and results would be visible in Wollongong as well as in the access centres. That was the vision, but it was introduced during a period of restructuring and thus considerable upheaval in the Faculty of Arts. The changes on the Wollongong campus were resisted; as was any suggestion that new learning technologies had anything positive to offer. Peter Taylor's (1999a) observations about the place of 'loss and grief in resistance' provide a rich framework for exploring the intense period that provided the context for my appointment as Head of the South Coast Project in the Faculty of Arts in April 1998. It was not a good time to be launching a new project.

In this unpromising climate I looked for several indicators of success: completion of teaching material on time was central, but also a sense of shared ownership of the project, enthusiasm for learning new skills and the adoption of some of the new teaching modes by academics outside the project group. There was success, achieved through partnerships both among members of the Faculty and with members of academic support units. The friendship and support within a self-identified 'core group' of subject developers and coordinators is a result of self-conscious team and partnership building in the Faculty. The process in the Faculty involved the academics coordinating the subjects in the B.A. (Community and Environment), including academics from the Aboriginal Education Centre, an educational development lecturer based in the Centre for Educational Development and Interactive Resources (CEDIR), several academics from Learning Development, and a change management consultant also based in CEDIR. In addition, links were made with the Library, Information Technology Services and the Academic Registrar's Division so that the Arts academics could gain an understanding of the larger institutional context of their work. While there are certainly dangers to applying corporate management literature to university governance, I have used Senge's (1990) model of organisational learning as a framework for the success story.

Peter M. Senge argues convincingly that organizations as well as individuals need to practice learning to meet the challenges of the contemporary economic change and resultant social changes. In *The Fifth Discipline* (1990) he argues that systems thinking is the necessary skill for meeting those challenges. The standard responses of a section of an organization can frequently lead to suspicion between workers who are immersed in producing their contribution to a desired outcome because of communication breakdowns. Problems that arise as a result of misunderstanding of vocabulary or processes may delay work in another section or be seen as a deliberate undermining of that section's work. Greater knowledge of how the system as a whole works and of one's own place in it reduces the chances of misunderstanding and thoughtless undermining during times of change. As a social scientist, I was already familiar with the explanatory power of systems theory in complex situations and as participant in academic and social movement politics, I was reasonably adept at using systems thinking to support interventions. However, most of the subject developers were relatively junior academics and not yet experienced in the university systems, nor in thinking about wider consequences of specific actions. Senge's (1990) model for a learning organization can be summarised in five points:

- Systems thinking
- Personal mastery
- Mental models
- A shared vision
- Team learning

The change management consultant introduced me to Senge's work as a part of her role in assisting team building among several groups involved in flexible delivery. It was clear that inward looking standard processes would result in both duplication of effort if groups worked in relative isolation from each other and in gaps and breakdowns in the delivery of technology, learning materials, training and support at the access centres.

Even in an encouraging context like the University of Wollongong, teamwork and partnerships do not simply arise, but have to be encouraged and facilitated (Scott, 1999). It was important that the Head of the South Coast Project (Arts) be a person with a strong vision of both the degree itself and the process for achieving success. I was already modelling the objectives of the project in my teaching practice: an emphasis on tertiary literacies (the current University terminology for generic skills), a willingness to try innovative methods of teaching and learning, a commitment to a student-centred curriculum, experience in interdisciplinary teaching and research, and strong team work capabilities. The individual Arts academics could not have produced the curriculum results on their own because most members lacked the 'mental models' for interdisciplinary teaching or research.

The culture of the Faculty was one of loyalty to discipline groups and suspicion of cross-Faculty activity (Becher, 1989). The strength of the culture can be illustrated by several members who refused to take part in the project because of the interdisciplinary nature of some subjects and the multi-disciplinary structure of the degree (see Taylor, 1999a): "When people's ideological identities are at stake, passions run deep" (Becher, 1989, p. 98). In addition there were comments by the 'refusals' who did not take part in the project. Some senior members of the Faculty worked against it and suggested that the participants were 'disloyal' to their disciplines as represented by the teaching program to which they belonged. The junior academics felt conflicted about how best to further their career opportunities at Wollongong since most were still on contract or probation; the program heads seemed more like gatekeepers to career success than did a senior lecturer leading an innovation. The South Coast offered opportunities to learn and practice new educational technologies in a supportive atmosphere, but the academics received little encouragement from their most immediate colleagues. The strong support of the Dean of Arts for team building and the project workshops was important to my ability to continue with the strategy of always building on the work that had gone before to enable the completion of the development tasks.

The project workshops aimed to develop a community of learners by promoting a shared trust, motivation, and vision of what the degree would be like (Senge, 1990). I worked in partnership with the change management consultant and the educational development lecturer and a tertiary literacies officer to make every group activity both move the project forward and build a team among the academics (Curtis et al., 1999). Project members learned to listen to those in other disciplines and expanded their mental models of teaching and learning. While it was certainly a case of uneven development, as their personal mastery increased, members took on different roles within the group. One academic in the team has shared her online teaching experience, developed with the help of the CEDIR based education development lecturer, with another Arts academic to create a flexible modular subject jointly taught and credited by two disciplines. It was an innovative subject made available in Wollongong two years ahead of delivery to the education access centres; a model for bringing together the approaches and analytic methods of two disciplines within a single subject. The success of the team building processes was demonstrated in the 2000 conversion and promotion round in which a group of junior academics pointed to their roles in the project in their applications and celebrated their achievements at a group lunch.

In addition, I facilitated the development of systems thinking among Arts academics by representing the group at many levels. I reported back to the project members, Faculty executive and Faculty Education Committee about these activities. I was a member of the campus wide South Coast Curriculum Committee that identified potential problems and guided the implementation of the various Faculty and support services plans. It was an opportunity to work closely with people from many areas of the University (Albury et al., 2001) and provided a level of support for the role of leader that was not available in the Faculty except from the Dean during the development stage of the project. I helped recruit and train casual tutors and was on the interview panel for the coordinators of the access centres. As the delivery of the subjects began, I travelled to the education access centres to enrol students and to support and consult with tutors. It's obvious that I, too, increased my personal mastery, challenged my mental models of academic work, developed a broader shared vision and learned in teams as I refined my abilities at systems thinking in the University.

As I said, it is an adventure story. If I stopped here I would be joining a long tradition of conference speakers who say what they did, but not how they did it. While it is of course, good leadership practice to speak in terms of what we have done, such talk obscures the task of the head who must create the sense of shared vision and responsibility in a disparate group of people. I want to now share with you an explanation of what I did as leader of a collection of largely inexperienced academics that allowed them to become an innovative and learning team in spite of the lack of support for their activities by some of the senior members of the faculty. I was able to draw on one of the advantages of working in a relatively small and less hierarchical institution; I could ask for help from anyone ranging from the Pro-Vice Chancellor (Academic) to level A academics in Learning Development. One source was the assistance of a change management consultant who had been employed under a CUTSD grant to facilitate the working relationships necessary for the successful implementation of flexible delivery. In a sense she played a role that I have often played in the past: the Head's 'best friend' (I think of this as a professional position). She served as a sounding board, encourager, workshop presenter and documenter; she made me challenge and expand my mental models of change and academic work, and she introduced me to management literature that was applicable to universities as well as the corporate sector.

Leading the South Coast Project (Arts)

When I became a leader with the title 'Head', I set out to read some of the leadership literature. Many of the ideas were familiar, that is, I already knew the underlying theory and the basic critiques, though the specific applications were unfamiliar. While much of the leadership literature highlights the role of a leader in envisioning, supporting and inspiring change (cf. Ramsden, 1998), it is important to remember that in higher education, some change is not inspired by anything other than necessity, nor worth whole hearted support (cf. Taylor, 1999b). Regardless of the critiques I needed some useful slogans or rules of thumb to direct my daily activity as a leader. The change management consultant provided some at first, but I recognised a list of five that describe my style in Paul Ramsden's *Learning to Lead in Higher Education* (1998, p. 111). Ramsden adapted the list from Kouzes and Posner, *The Leadership Challenge* (1987). They point to five practices with two commitments to action for each:

- Challenge the Process - Search for Opportunities; Experiment and take risks
- Inspire a Shared Vision - Envision the future; Enlist others
- Enable others to Act - Foster collaboration; Strengthen others
- Model the Way - Set the example; Plan small wins
- Encourage the Heart - Recognize contributions; Celebrate accomplishments

As with many stories that can be told within a clear framework in hindsight, this account comes after I had been practicing leadership; after all I didn't read Ramsden until late 1999 as the development phase was completed and implementation was beginning. Nevertheless, I will now explain what I did as leader within Kouzes' and Posner's five point model. Certainly the early stages of the South Coast Project were about challenging the process. Even before I became the Head, while I was a member of a single subject development team, I was searching for opportunities within the institution. When the three of us first learned that our related subjects were selected for flexible delivery, we began to experiment with Majordomo discussion lists in our other classes and to talk with others who were already doing so. The students at the Wollongong campus have entered into the spirit of our experiments; they have thoughtfully offered advice on what worked and what didn't and reflected on their educational experiences at the same time.

The Arts Faculty had a strong individualistic culture that focused inward toward the disciplines and encouraged competition rather than collaboration. We began our formal work with a workshop on surviving and thriving in times of change. This created an opportunity for many Project members to get to know each other in a setting that was removed from the Faculty and its politics. At the same time the facilitator encouraged us to talk about the restructuring and the changes and to reframe ourselves as change agents through our participation in the South Coast Project. The scene was then set to shape and implement change rather than be helpless in the face of the inevitable. The early project workshops were focused on the key tertiary literacies that would be built into the degree. A fluctuating group of Arts academics attended and built solidly on the work of the past workshop (Curtis, et al., 1999). The workshop process built a complex table of academic skills to be developed in the subjects based on the shared understandings of the disciplinary traditions of the humanities and social sciences: critical thinking, problem solving, written and oral communication, research skills and application, computer and information literacy and social interaction. These skills were sequenced through the degree with learning and assessment tasks that promoted increasing mastery. The operating slogan at that time was, 'only move forward' and it worked in a Faculty where the proposal for a 'let's talk about it again' committee was a standard response to any change.

The subject developers had little experience of curriculum design, and little knowledge of the approaches to learning that were particular to other disciplines than their own. A couple of experienced academics in the group were enthusiastic and open about learning from the others, making it possible for the less experienced people to ask questions and expose areas of ignorance in a safe setting. The excitement of seeing their growing understanding of the intrinsic integration of learning skills and subject content encouraged all participants. Later workshops were devoted to skills development, visiting Nowra and meeting representatives of other units of the University involved in the South Coast work. Meeting other stakeholders enlarged the vision from that of a B.A. to a University project. As the subject developers contributed to shaping the vision of the degree and then the implementation of that vision they were fully enlisted in not only the immediate project but also the larger project of rethinking teaching and learning within the Faculty.

Once the Arts academics began to think differently about teaching and learning, they began to act on their ideas. I described how two developers have turned a previously discipline-based subject into an interdisciplinary one. The enthusiasm of the two has encouraged some of their previously reluctant colleagues to try using WebCT as a communication or content delivery tool in their subjects. As recently as early 2000, website development was perceived as the domain of CEDIR programmers or especially skilled research assistants, now it is on the way to being a part of some administrative support job descriptions. By fostering collaboration, sharing knowledge of how the University worked and building skills in the workshops I enabled the two women to act with rather than against the strategic direction of the Faculty and they in turn have enlisted others in the collaboration.

I formally led the workshops and modelled the processes the group were learning. I practiced the technology skills that we all were learning, transferring them to another project. Most importantly for any leader of an educational innovation, I looked for and found support for myself in the role of Head both within the Faculty (the Dean) and outside (the change management consultant, an education development lecturer and a senior University administrator). These four provided a much needed reality check in an atmosphere of continuing neglect, to the point of denial, of the project within the Faculty and hence recurrent waves of concern among the subject developers. My supporters offered a safe place for me to express my doubts and despair and receive reassurance and reminders about how far we had moved. While this is not overtly one of the five points in the model, I would argue that a small support group is an important part of enabling the leader to act. Universities are not noted as places where support is automatically offered to struggling middle managers, often the struggles and the small successes are not noticed, though failures are discussed. If I was going to lead change in an atmosphere that frequently lapsed into negativity and resistance, then I needed to have my standard responses challenged in a safe space, to be strengthened, and to celebrate my accomplishments.

It is clear that planning small wins is much the same as only moving forward. We used workshops to divide the project into smaller pieces and then 'do' them. Since most subjects were going to be developed by a single academic, I wanted to create a place of safety for sharing questions and achievements. It had to be safe for the most technologically incompetent person to ask for and receive help from a much younger person without comment. Hence, the process began by an attempt to create coherence for the interdisciplinary degree through articulating the intellectual skills at its centre: critical analysis, research, oral and written communication, careful reasoning and a clear understanding of the interconnectedness of important ideas and social issues. Through those discussions and the increasingly detailed documents that grew from them, people learned to listen to and appreciate the perspectives of others and to better understand the larger tradition of making shared meanings that constitute the humanities and social sciences. Once that process was complete (it took many months), subject developers could see where their particular subjects fit in the whole and were ready to share and learn new skills to make it happen.

Once the development began to happen in a concrete way, it was important to support and encourage academics who were working alone with very little time release from their other teaching duties. In an education sector that today is noted for low morale, I tried to make the project work a place of reward, not an additional burden. At many project meetings I made a point of going around the table so each developer could discuss current successes and problems. Usually they found one's success was the solution to another's problem. This was an opportunity to acknowledge the very different contributions that people made to the project. I have written promotion and job references and made available an endless supply of chocolate, biscuits and hot drinks. I have tried to celebrate the accomplishments of the project members with public announcements to the group as a whole. I did not begin being 'Head' with this five-point model in mind, it describes many aspects of my practice. Ramsden (1998, p. 110-119), too, draws the work of Kouzes and Posner and Senge together in his discussion an approach to leadership in the current context of Australian higher education.

Conclusion

I have discussed my leadership of the development of the B.A. (Community and Environment) in this paper. The first years of implementation are a 'further instalment' since I have taken on the role of coordinator of the degree program and the public face of the Arts degree on the South Coast. Few projects involving educational technology are complete once the initial development phase is over. The longer term implementation and smooth continuation of the project depends on similar leadership skills. This development story is one of personal and organizational learning. It is also an example of success as a result of leadership that enlisted colleagues to take risks and extend their skills and sense of responsibility for the outcomes of the project. If members of the project group can learn some of the systems thinking skills along with the project specific tasks, the changing context of implementation with its challenges to the original vision will be less onerous, for there are still many changes to be made. The pride that the members of the project share in our accomplishment is not so much 'we did it' as 'we are doing it'.

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SOME LESSONS FOR HIGHER EDUCATION FROM THE ECONOMICS OF ELECTRONIC COMMERCE

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Abstract

The arrival of the Internet has been seen to portend the rise of the virtual university, global competition and the end of campus education. The emerging economics of electronic commerce allows for a measured understanding of the implications of the new technologies for higher education and even how educational innovation should be focused. Four lessons emerge. First, campus education is probably a normal good in that demand for it increases with income. Second, electronic commerce alone does not provide grounds for significant changes to university offerings. Third, new partnerships and delivery mechanisms will emerge but not dominate. And fourth, there will be pressure from a variety of sources to enhance campus education in light of the new information technologies and practices.

Keywords

economics, higher education, information technology, electronic commerce, virtual university, online instruction

Introduction

The rise of the Internet, its attendant information technologies and their application to business has engendered a great deal of hype. Commentators have, among other things, heralded the arrival of a new economy and foretold the total transformation of higher education, including: the rise of the virtual university, global competition in education and the end of campus education. The purpose of this paper is to see what can be made of the future of higher education in light of the emerging economics of electronic commerce (eCommerce). Like eCommerce itself, the economics of eCommerce is an emerging field and many of features of both are yet to stabilise. However, from the perspective of economics, some of the salient features of eCommerce seem quite clear, even at this early stage, and much of this is relevant to a measured understanding of the implications of the new information technologies for higher education.

In section 2 below consideration is given to just what constitutes eCommerce and why it matters. The forces at work in its uptake across the economy are examined. The key concepts of transaction and organisational costs are defined and discussed, as are some possible economic and labour market effects of eCommerce. Scrutiny is then turned to the lessons of all this for higher education in section 3. Some concluding observations are offered in section 4. Finally note that this is a paper for non-specialists and terms are defined as they are introduced.

Some Economics of eCommerce

There is no single, well-established, and widely accepted definition of eCommerce. However, this is not a serious impediment. For present purposes it is sufficient to follow the OECD view of eCommerce as: "business occurring over networks which use non-proprietary protocols that are established by an open standard setting process such as the Internet" (OECD, 1998).

Moreover, the term "business" is to be understood broadly to include both networked activity between, and within, economic units like firms, households, government agencies and institutions of all sorts (including, of course, institutions of higher education). This definition also nicely reflects the fact that eCommerce is a new way of doing business not just a new business sector.

Much of the discussion of eCommerce has focused on new information products and networks per se and has under-emphasised the significance of the Internet and its attendant technologies for the most fundamental costs of doing business, the costs of transacting and the costs of organisation. (These terms are discussed in more detail below.) The potential of eCommerce to reduce these costs is of the first importance because they don't just affect Internet service and content providers or even just those firms with computers. Transaction and organisational costs affect every business, every household, every government agency and every educational institution. This is why eCommerce is best seen as a whole new way of doing business, rather than just a matter of firms developing an Internet version of their product catalogues or something for consumers with a liking for gadgets.

Lest this point be overstated, note that eCommerce does not imply a new economy in the sense of a radically changed set of outputs or fundamentally different social institutional forms. (Parham (1999) contends that there may be a new economy in the sense of a new productivity growth path, but that is another matter entirely.) While some new markets, products and firms are emerging; it is the processes of business that are changing significantly not its content. Indeed, it is simply not a matter of choice for firms in the advanced economies: they must pursue whatever transaction and organisational cost savings are offered by eCommerce. And, moreover, while these opportunities are being explored there is likely to be a great deal of trial and nearly as much error, as recent rash of dot-com failures illustrates only too well.

A transaction cost is anything that interferes with or limits the ability of agents (firms, households or institutions) to pursue and make mutually beneficial exchanges in markets. These difficulties are often, at base, problems associated with acquiring the relevant information. Among a host of other things, these information problems can lead to costs in: locating an exchange partner, specifying precisely what is to be exchanged, agreeing a price, and ensuring that which was to be exchanged, was actually exchanged.

Organisational costs, on the other hand, are anything that inhibits an agent's ability to consciously coordinate their activity to achieve some understood objective within a single economic entity; that is a particular firm, household or institution. Again these difficulties are primarily informational in nature. In a firm this class of costs relate to the coordination of production, logistics, the operation of management information systems and internal communications in general. The organisational costs of a firm do not include marketing and input procurement costs as these arise from the use of the market and are better regarded as transaction costs in the sense employed here.

There seems to be, as yet, no systemic wide-ranging empirical study of the comparative transaction costs of conducting business via the various means now available: face-to-face, mail order catalogue, telephone, and now via the Internet. However, there have been a number of industry studies conducted. Thus, for example, it has been estimated for the US computer software industry that seller transaction costs are $15 for face-to-face transactions, $5 for telephone transactions, and between 20 and 50 cents for Internet transactions (Bollier, 1996). A set of Australian estimates puts seller transaction costs for a sales representative visit at $300, a customer initiated face-to-face transaction at $25 to $30, a telephone transaction at $4 to $8, and an Internet transaction at less than 25 cents (Callaghan, 1999). As an illustration of organisational cost savings, consider the case of Ford Motor Company's move to use an Internet system for processing the more than one million travel and expense account reports employees submit each year. Large corporations like Ford spend about $36 on processing each paper-based expense report. With the Internet and electronic downloading of credit-card receipts, it is estimated that the cost can drop to about $4 per expense report on average (Warner, 1999).

If the relative organisational and transaction costs are of the order indicated above, it is little wonder that eCommerce has captured so much attention and expanded so rapidly. Indeed, given the competitive pressure faced by firms, it is to be expected that the uptake of eCommerce will be fastest in firms and for transactions between firms. (A raft of estimates of business-to-business eCommerce puts it at between 61% and 90% of all eCommerce activity (OECD, 1998)). In competitive industries it is matter of survival, not taste, for firms to minimise costs, including organisational and transaction costs. Interacting firms will drag their business partners into eCommerce as both can gain from doing so. Similarly, firms in less competitive industries will be pressured to adopt best practice eCommerce to minimise transaction costs in the presence of the discipline of increasingly net-savvy capital markets. In short, for the firm there seems little escape from the clutches of eCommerce. The pressures of competition will see its adoption wherever there are cost savings to be made.

The competitive pressure on firms to adopt eCommerce does not, however, apply to household members acting as final consumers. Here tastes, or consumer preferences, drive behaviour rather than the requirements of cost minimisation. In standard economic theory, consumer choice is seen as a process in which agents do the best they can in light of their preferences over all possible bundles of goods, given market prices and their income. With the introduction of eCommerce the pattern of consumer preferences can be extended to cover the various means of transacting business. Otherwise identical goods can be distinguished on the basis of the means of acquiring them. For example, we can distinguish between buying a book in a face-to-face visit to a bricks and mortar bookstore and buying the same book over the Internet. Clearly, the two are quite different experiences, where the purchasing experience is part of what the consumer buys. In this setting it is a simple matter to generate two general theoretical results. First, the introduction of a new transaction experience like eCommerce yields an unambiguous welfare improvement for consumers and society, as will any subsequent reduction in the transaction costs of conducting eCommerce. Second, with the introduction of the new means of doing business there will be an unambiguous fall in sales involving the pre-existing means of conducting business (controlling for other variables like population and income levels). However, after this first shock, the impact of further reductions in the costs of the new means of transacting are not as clear cut for the sales of both new and old products, as both income and pure price substitution effects are involved. This, in itself, is a very important result as, over time, with increasing incomes or reduced prices, it is perfectly possible for the sales by both means to rise.

The whole issue here turns on whether the product characterised by the pre-existing means of conducting business (say, face-to-face) is a normal or inferior good. A normal good is one for which consumption rises as income increases while controlling for all other influences on consumption. An inferior good is one for which consumption falls as income rises, again controlling for other influences on consumption. (In Australia, for example, in aggregate mutton is an inferior good while lamb is a normal good.)

The upshot of this distinction between normal and inferior goods is that so long as the product characterised by the pre-existing means of conducting business is not an inferior good it is quite possible for its sales to rise, along with those of the eCommerce product, as incomes rise or the cost of the latter falls. The effects of the introduction of the VCR on the movie industry provide an instructive illustration. At first the VCR was greeted with a great deal of concern about its implications for cinema ticket sales. In effect consumers now had a new means of purchasing and consuming the movie experience: renting a video and watching it home. This was a new means of acquiring the good and is quite different from the previously established modes: going to the cinema or going to the drive-in. Just as would be expected on the basis of the modelling outlined above, attendances at both cinemas and drive-ins both initially declined with introduction of the VCR. Over time, however, in the presence of both rising incomes and falling total cost for watching movies at home on a VCR, the sales of cinema tickets recovered to now exceed pre-VCR levels. Drive-in ticket sales, however, did not recover and continued to fall to the point where the drive-in has virtually disappeared. In the terminology introduced above, the cinema movie experience would seem, in aggregate, to be a normal good but the drive-in movie experience an inferior good. Total expenditure on cinema tickets and movie rentals could, and did, both rise as incomes rose and the price of watching a video at home fell, while the same two phenomena combined to kill off the drive-in.

While household agents acting as final consumers are free of the competitive pressure firms face to adopt eCommerce, it is quite a different matter when household agents act as sellers of productive inputs, like labour services. Over time the pressure of competition between agents seeking to sell labour services will see those agents acquire the skills demanded by buyers of these services. As firms adopt eCommerce under the requirements of cost minimisation there will be increases in the demand for the staff required to support, and be proficient in, the new means of conducting business. The sellers of labour services can be expected to respond to this shift in demand, the result being a general increase in eCommerce skills. This, in turn, will have a derived demand effect in the education and training sector. This is a topic for further consideration in the next section.

For government the case may seem more like that of final consumers, where the tastes of decision makers may be a critical determinant of the extent to which the practices of eCommerce are applied. However, two factors would seem to work towards a rapid uptake of eCommerce by government agencies. First, demand by agency clients for the provision of eCommerce interfaces, for instance where firms are users of government information; and second, the pressure on governments to minimise costs in the provision of services to allow either the provision of additional services without increased taxes or offer the same services with lower taxes. Indeed, there is probably just as much scope for the use of eCommerce in the re-organisation of government agencies and their relationship with their constituencies as there is for the restructuring of firms and the markets within which they operate.

The significance of eCommerce for inter-action between agents via markets and their intra-actions within firms and other organisations means, as already observed, that eCommerce is better treated as a new means of doing business rather than a new, somehow separate, sector of economic activity. For the economy as a whole, the significant potential transaction and organisational cost savings implicit in eCommerce imply significant potential improvements in economic efficiency and an increase in the long-term growth in aggregate output. Savings on transaction costs will release resources that would otherwise have been absorbed in transacting or organisation alone. These resources will be available for the production of more and new goods and services. In the first instance, these costs savings will be associated with better managed inventories, cheaper sales execution, more effective procurement, and cheaper intangibles like banking and distribution. All this should allow an improved coordination of productive activity, leading to the better allocation of resources and significant productivity improvements. And it would seem that evidence of this is already appearing for the economies rapidly taking up eCommerce (Coppel, 2000).

Some Lessons for Higher Education

Four broad lessons for higher education can be drawn from the preceding review of the emerging economics of eCommerce. First, and most importantly, the future of campus education turns, in part, on whether it is a normal or inferior good. This distinction makes it possible to address questions like, what will happen to the demand for the shared, face-to-face, educational experience offered on thousands of different campuses across the globe in light of the alternatives provided by online instruction? What initial impact will the new delivery mode have and what will be the longer term effects as incomes rise and the costs of online delivery fall?

Economic choice theory modelling suggests that the introduction of a new delivery mode will be associated with a short-run decline in the demand for campus education. This decline might only be in the form of a reduced rate of growth as other variables affecting demand for campus education are also continuously changing like population levels and age composition, income levels and the returns to higher education. As for the longer term, there are strong grounds to see campus education as a normal good, that is demand for campus education rises with income and might even rise as the cost of online education falls. Thus in the short term there might be relatively low, or negative, growth in the demand for campus education and rapid growth, from a very low base, for online delivery. In the medium to longer term this seems likely to reverse with relatively strong growth in the demand for campus education and relatively weak growth in online delivery.

The second lesson follows from the far-reaching potential of eCommerce as a new way of doing business that can reach into all aspects of our lives. This suggests a correspondingly far-reaching integration into education and training. Information technology literacy might become as important as numeracy in education at all levels. Indeed, the requirements of change alone, and eCommerce in particular, have far reaching implications for education, training and the labour market in general. Success in the new way of doing business means new skills, new outlooks and a new commitment to life-long learning. Preparation for success in the new way of doing business is much more than teaching students HTML, or even web competencies. None of us can know how we will be working in five or ten year's time. To take on the new challenges and seize the new opportunities it is more important than ever that members of the workforce have critical and analytical skills, the desire to learn and understand, and the ability to think from different points of view. (In fact, just the sort of things valued in higher education). This means that in our desire to prepare for a world in which the web and its technologies are as commonplace and ubiquitous as the telephone we must not forget the existing arts and sciences that provide the myriad other competencies required for a fast changing, vibrant modern economy. Little, if any, of what of universities have traditionally done is less relevant and there is good reason to think that most of it will be more relevant.

The third lesson from the economics of eCommerce is that publicly funded institutions of higher education have to expect increased pressure from governments to exploit the new information technologies to reduce costs or do more with the same resources. Governments are under constant pressure to provide more services from a given tax income or the same services from a smaller tax income. (Indeed, in Australia the Department of Education Training and Youth Affairs and the National Office of the Information Economy have launched a project to explore the opportunities for business-to-business eCommerce in higher education (NOIE, 2000)). Combined with this pressure from governments will be demand for information technology competencies from employers and from students with an eye on their employability. Institutions of higher education will have to thoroughly embrace the new way of doing business: it will be demanded of them by their funders and there will be a demand for it by education consumers, both students and the employers of graduates.

The fourth and final lesson derives from the fact that new products are a relatively unimportant part of the wide raft of implications of the development of eCommerce. There is simply not a 'new economy', in any profound sense, or even the birth of an 'information economy' or a 'knowledge economy'. Information and knowledge have always been fundamental to economic activity. There will be some new products and new organisational forms, with the changes perhaps being in the order of those associated with the arrival of the telephone or modern electricity generation and supply systems. The rise of eCommerce is not on a par with, say, the development of equality before the law or the invention of the limited liability joint stock company.

There will certainly be a place for online delivery of higher education and new partnerships with industry in research and life-long learning, but the fundamental place of universities is not at threat from the arrival of new information technologies. (Bad policy decisions in particular political jurisdictions are, of course, quite another matter). If anything, the increased role for information technology, innovation, economic globalisation, and the rapid rate of change all point to a more substantial place for, and more, university education and research, not less. To take that place universities will have to seize the nettle, embrace the technologies and the new ways of doing business. The campus educational experience must be enhanced and enriched by the new technologies and practices, not abandoned because of them. Moreover, this is not just a matter of meeting demand (giving students a campus education because they like it, which is a good thing in itself); it is a strategic matter: campus education can instil many of the traits required in an advanced, rapidly changing economy: communication skills, critical thinking, a willingness to subject ideas to the data, the joy in learning, flexibility and the ability to work in a team. Indeed, success in developing these very skills is critical to success in capturing the potential of the new ways of doing business.

Conclusion

In summary then, the four lessons for higher education from the economics of eCommerce are:
remember that campus education is a normal good;
the arrival of eCommerce alone does not provide grounds for significant changes to university offerings;
new partnerships and delivery will emerge but not dominate; and
expect pressure from a range of sources to enhance campus education in light of the new practices.

New virtual universities, or virtual incarnations of established institutions, will not sweep aside their rivals and dominate higher education across the globe. (If information technology alone could make this sort of difference, then surely the VCR and TV would have already done so). Location and the campus educational experience matter and will continue to matter. Indeed, perhaps the most important educational opportunity provided by the new information technologies is in enhancing the on-campus experience by allowing more resources to be committed to those elements of the campus experience that matter most to students.

The normal good characteristics of on-campus education and falling transaction and organisational costs lend a certain logic to the likely evolution of higher education. None of this is, however, immune from bad policy decisions. For instance, flying in the face of the normal-good nature of campus eduction could be a national disaster, with too few acquiring the skills required for the full realisation of the potential inherent in the new information technologies. Governments can fail, just as markets do in certain circumstances. In light of the apparently dazzling array of new opportunities and the increasing economic importance of university education and research getting higher education policy right has become more important. As always, the only hope for getting it even approximately right is intense, critical and well informed debate.

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USING KIRKPATRICK'S FOUR-LEVEL-EVALUATION MODEL TO EXPLORE THE EFFECTIVENESS OF COLLABORATIVE ONLINE GROUP WORK

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Abstract

This paper examines two cohorts of students, each engaged in the same course of study but using different means of engagement. One cohort of 90 students completed a real time learning program integrating group dynamics, action research, team performance and participative decision-making (Tuckman & Jensen, 1977; Belbin, 1981; Dick, 1986; Hopson & Scally, 1982). A second cohort of 171 students completed the same course of study in an online environment. Satisfaction ratings were drawn across the real-time and online cohorts, the data structured and critically mined using a four level evaluation of learning model (Kirkpatrick, 1996) to explore student-learning outcomes related to online group work.

Findings indicate that the real time student sample recorded a significantly higher satisfaction rating in some aspects of their group learning experiences than their online counterparts. Further examination of the learning outcomes of the online cohort of students using level two, level three, and level four evaluation strategies (Kirkpatrick, 1996), suggests that the online group work model successfully supports group learning behaviours, transfer of these behaviours to practice, and improvement in learner behaviours at the enterprise level. Despite some differences in between group learning outcomes, online group work was seen to add value to the group learning experience.

Keywords

online group work, evaluation studies, online pedagogy

Introduction - The Centrality of Group Work

Group work has emerged as a strategic curriculum response among business educators attempting to come to terms with an entrenched industry, enterprise and graduate focus on teamwork. The fact that organisations have continuously moved toward an internal structure based on work teams or groups has not escaped the focus of management educators. This is manifest in a curriculum focus that treats (as routine) aspects of socio-technical work design, quality circles, TQM and their corresponding models of human and intellectual capital. The workplace is no longer the frontier of individual achievement for the 'top gun' graduate, but is painted more as a 'networked' environment peopled by graduates with the skills to work in a team setting (Cordery, 1996; Cohen & Ledford, 1994).

Understanding small group formation, its dynamics, processes and outputs remains a key element in the provision of effective learning environments (Hogan, 1999; Baskin & Greenfield, 1999). Some of the perceived benefits underlying our use of groups as a learning technology point to the benefits of efficiency and productivity. Groups accomplish tasks that cannot be done by individuals alone. They bring multiple perspectives to bear on a single problem and in doing so they capture the dynamic of real world complexity. Groups provide a vehicle for decision-making and taking, and they impose an efficient means of organisational control over individual behaviours. Groups also form a key element in the broader social system. They are instrumental in the formation of personality, are agents of both socialisation and control, and act as a motivational tool within a continuous cycle of work-based learning.

In an effort to demonstrate an appropriate response to the learning needs of new graduates (and the demands of accrediting bodies), group work has emerged as a common feature of many contemporary management classrooms. The rationale here is as transparent as it is formidable. By exposing students to working within a peer-based team, then by osmosis (or some other 'learning' process), students would likewise inherit a capacity and propensity to handle corresponding group interactions, challenges, conflicts and dynamics. Yet herein lies one compelling reason why group work has long suffered as a result of inadequate epistemology. Merely exposing students to group work has not yet proven to be a guarantee that these same students will evolve into efficient and effective team members. Poorly defined group tasks, a lack of group skills training, and a low level of autonomy for learning teams to remedy learning problems are amongst the reasons cited for group work failure (Hogan, 1999). In part these failures are traceable to larger systemic features, in particular the competitive framing of our higher education system, and the logistical difficulties the 'marker' faces in assessing and reporting on individual performance within a group learning context.

Where this Paper Began

In 1998 I began to question the 90 students enrolled in a second year management subject about past group work experiences. Most relayed negative, at times frustrating and frequently alienating experiences of 'team work' and vowed to avoid it where possible in the future. Based on this feedback, I revamped the design of the subject to include a focus on 'industry-style' team-building efforts, with a clear competency framework, and demonstrable learning outcomes (Baskin, 1999). The 'target subject' integrated aspects of group dynamics, action research, team performance and participative decision-making (Tuckman & Jensen, 1977; Belbin, 1981; Dick, 1986; Hopson & Scally, 1982). In 1999, this same course 'went online' with a cohort of 171 students, and dealt with the 'prickly problem' of group work in an emerging and new (virtual) context. This paper is an account of this shift in two distinct stages. The first stage addresses the shift from 'real time' to 'online' technologies and presents between group ratings of each group work process. The second stage of the paper examines the online behaviour of students engaging with group work, and analyses the patterns of learning behaviour that characterise group work in a 'virtual environment'. The paper offers four levels of evaluation of group skills learning based on those developed by Kirkpatrick (1996). This classification scheme is offered as an effective framework for evaluating enterprise-learning programs and for determining the effectiveness of this learning, its impact on the institution and the learning behaviours of its students.

Students, Subject and Context

Two cohorts of the same undergraduate subject are discussed here. In the first instance the class consisted of 90 students, and in the second it comprised 171 students. Both classes completed the same assignments, used the same text, materials, participated in peer assessment and had access to the same facilitators. The assessment in the subject was predominantly collaborative, and both cohorts undertook all enquiry tasks in a group context. The second and larger cohort completed all group work and peer assessment online.

Student Perceptions of the Collaborative Learning Process - Level One Satisfaction

Students in both cohorts were asked to respond to six statements related to their understanding of the group work process, and their perception of their peers as markers. Responses were rated on a five point scale ranging from 1 = strongly agree to 5 = strongly disagree. Results of a statistical breakdown of all student responses (cohorts 1 & 2) are shown in Table 1 below.

Factor	Mean	SD
1. I understand the group work process	1.80	.85
2. I believe the group process is a valid way of learning	2.05	.92
3. I am confident in peer assessment processes	2.10	1.05
4. Peer assessment is an equitable form of grading	2.20	1.00
5. My grades reflect my efforts in this subject	2.20	1.05
6. I became more effective as a member of a team	2.30	1.08

Table 1: Student responses to group work and peer assessment (n=261)

Across the total population of students the results of Table One reflect an approximate level of agreement, and a 'narrow' distribution of values (mean SD approaching 1). This is a positive endorsement of group work and peer assessment practices by students. Further analysis of between-groups data (Online Group = 171) and (Real Time Group = 90) reflect that some significant differences in perception do emerge around factors 3, 4, 5 and 6. The data cited in Table 2 (below) indicates a stronger preference by real time group work students (a lower Likert scale rating) for collaborative group work in student perceptions of confidence, equity, return for effort, and effectiveness ($t[259] = 3.06$, $p<.05$), ($t[259] = 2.80$, $p<.05$), ($t[259] = 2.70$, $p<.05$), ($t[259] = 3.40$, $p<.05$). Despite these differences, learner perceptions of their understanding of group process theory, and of collaborative learning as a valid learning technology do not differ significantly in online or real time settings.

Factor	Real Time Cohort Mean	Online Cohort Mean	p-value
1. I understand the group work process	1.70	1.85	.178
2. I believe the group process is a valid way of learning	1.96	2.10	.282
3. I am confident in peer assessment processes	1.90	2.30	.003*
4. Peer assessment is an equitable form of grading	1.94	2.30	.006*
5. My grades reflect my efforts in this subject	1.96	2.30	.007*
6. I became more effective as a member of a team	2.01	2.50	.008*

*significant at p<.01

Table 2: Comparison of real time and virtual group work cohorts on group and peer assessment processes

The overall satisfaction level of both cohorts of students (Mean = 1.88) indicates that students in both the real time and online group settings remained highly satisfied with the group work experience, and that the range of variation in response across cohorts was rather narrow (SD = .84). A between group analysis was conducted in order to ascertain which if any differences in between-group perceptions may apply to either online or real time group learning contexts. These results, presented in Table 3 raise some relevant questions about the context of online group learning, pointing to a significant difference in the perceived satisfaction of real time as opposed to online group work participants ($t[259] = 2.49$, $p<.05$). The higher perception of satisfaction in this instance belongs to those students who undertook collaborative group work in a real time setting. Level one evaluation of this kind is purely and simply a measure of 'customer satisfaction' (Kirkpatrick, 1996), and not a measure of the 'quality' of the participants' experience. It is nonetheless an important initial measure of participant response, and one that in this case raises the warrant for further examination of why this intergroup difference in perceptions exists.

Factor	Real Time Cohort (n=90) Mean	Online Cohort (n=171) Mean	p-value
1. Level of Satisfaction	1.70	1.97	.013*

*significant at p<.01

Table 3: Perceived satisfaction of real time and virtual group work cohorts

Further analysis of the student sample focused on work experience (*t*[259] = 1.85, *p*<.05) indicating no significant differences in reported satisfaction as a result of industry background. A final ANOVA was undertaken measuring the degree of satisfaction across four age group categories (<20, 21-25,26-30,>31). The results (F[3,257] = .277, p>.05) again point to no significant differences in reported satisfaction as a result of age related factors or frames.

Level Two Evaluation - What was Learned?

At this point, it was decided to focus on the level two question of 'what was learned' and 'what wasn't learned' in online group work as a means of gaining some background into why online group work was perceived by students as less satisfying than its real time counterpart. A level two evaluation tests participant learning (Kirkpatrick, 1996), and generally takes the shape of an evaluation of 'what was learned'. In this case 136 valid responses were collected from the online cohort. This evaluation process was a replication study (Hogan, 1999) the purpose of which was to capture and bracket student accounts of group learning in an online environment. A summary of results is provided in Table 4 (below).

The tabled results (Table 4) indicate that students endorse online group work as an appropriate forum for learning and assessment, and list a range of learning outcomes. The table indicates a high level of acceptance of responsibility for self-directed learning (89.8%), and self-management (80.9%) respectively. The students also report positively on their learning about aspects of group behaviour (82.4%) and the challenge of group facilitation (75.7%). Emphasis on aspects of member participation indicate an increased awareness of how 'my behaviour effects others' (64.4%), experience with hands on conflict management (55.9%), managing group processes to include 'quiet' people (69.9%), and in dealing with the dominant personality (61.6%). The online environment was clearly able to stimulate a broad range of 'authentic' group and interpersonal challenges for learners.

The formation of 'new learning networks' was also a feature of student responses. Some 80% of respondents made new friends, 78% engaged in cross-age learning groups, and 86% of students reported the opportunity to observe 'different personalities'. Students saw the online method of group work and assessment as somewhat 'unorthodox' (52%), and nearly half informants declared that they felt at risk 'at first' (43%). Yet corresponding attributions of better self-management (81%), and more meaningful engagement with others '*I wouldn't normally be exposed to*' (71%) indicates that students relied on group behavioural theories and models (82%) to build dialogue between theory and practice in a real world setting (79%).

Individual perspective	**Agree**			**Disagree**		**Unsure/DK**
	No.	**(%)**	**No.**	**(%)**	**No.**	**(%)**
Learnt more about myself	82	[60.3]	21	[15.4]	33	[24.3]
Made new friends	108	[79.5]	15	[11.1]	13	[9.6]
Learnt more about old friends	59	[43.4]	26	[26.4]	41	[30.1]
Felt at risk at first	59	[43.4]	45	[33.1]	30	[22.1]
Learnt to speak up in a group	75	[55.1]	30	[22.1]	30	[22.1]
Can remember experiential exercises more easily	60	[44.1]	15	[11.0]	60	[44.1]
Learnt to further develop trust in other students	82	[60.3]	21	[15.5]	31	[22.8]
Learnt to facilitate a group	103	[75.7]	15	[11.05]	18	[13.2]
I took responsibility for my own learning	122	[89.8]	6	[4.4]	8	[5.9]
Relate organisational behaviour theories to real world	107	[78.7]	14	[10.3]	15	[11.0]
I felt Qualified to give feedback	93	[68.4]	22	[16.1]	21	[15.4]
I felt the feedback received was adequate	93	[68.4]	18	[13.3]	24	[17.6]

Group perspective						
Learnt about people I wouldn't normally be exposed to	97	[71.3]	12	[8.8]	27	[19.9]
Learnt about group behaviour	112	[82.4]	7	[5.2]	17	[12.5]
Mixed with students from different cultures	78	[57.3]	36	[26.4]	22	[16.2]
Showed up immature students	50	[36.8]	26	[26.4]	49	[36.0]
Watched power struggles	58	[42.7]	33	[31.6]	35	[25.7]
Saw how my behaviour affects others	88	[64.7]	16	[11.7]	31	[22.8]
Mixed with students of different age groups	106	[77.9]	13	[9.6]	16	[11.8]
Confront people exhibiting dysfunctional behaviour	34	[25.0]	52	[38.2]	50	[36.8]
Fun	88	[64.7]	22	[16.2]	26	[19.1]
Chance to observe different personalities	117	[86.0]	7	[5.2]	12	[8.8]
Gave me experience in conflict	76	[55.9]	25	[18.4]	34	[25.0]
Deal with people with dominating personalities	85	[62.5]	26	[19.1]	25	[18.4]
Others took responsibility for their own learning	96	[70.6]	13	[9.5]	27	[19.9]
Learnt to include quiet people	93	[68.4]	12	[8.8]	30	[22.1]
The project						
Unorthodox/unusual way of learning	71	[52.2]	33	[24.2]	31	[22.8]
Learnt to be task orientated	102	[75.0]	8	[5.8]	26	[19.1]
Learnt to manage myself	110	[80.9]	13	[9.6]	13	[9.6]
Learnt to manage ourselves	93	[68.4]	18	[13.3]	25	[18.4]
Gave me experience in planning	106	[78.0]	10	[7.3]	20	[14.7]
Gave me experience in time management	106	[78.0]	10	[7.3]	20	[14.7]

Table 4: Summary statistics – Student perspectives online learning

Results captured in Table 4 tend to suggest that online learning groups and peer-assessment processes provide a translational learning model that is able to situate students within contemporary organisational learning processes. Online group work is shown to enhance curriculum planning, by providing an effective frame for the teaching of group development theories (Tuckman & Jensen, 1977), team-roles (Belbin, 1981), conflict resolution skills (Dick, 1986) and the processing of feedback (Hopson & Scally, 1982). This continuous group learning cycle provided a climate of exchange, promoted learning to learn through materials, activities, modelling of behaviour, self-reflection and assessment (Baskin & Greenfield, 1999). On the surface level two data (Kirkpatrick, 1996) seems to endorse the learning outcomes of the subject. What was being learned in online group work was the product of a deliberate and active pedagogy.

Level Three Evaluation: Was the Learning Being Used?

Level three evaluation functions as a check to see if the skills base underlying the pedagogy of online group work is actually being accessed and used by students (Kirkpatrick, 1996). Analysis of the online learning behaviours identified in Table 4 reveals a high level of uptake and implementation in online group work episodes. In the tertiary setting, learning outcomes must initially engage existing student frameworks but at the same time remain relevant to the goal of acquiring new knowledge and skills. In this light feedback identifies online group work as a multi-directional process that occurs within and across groups of learners. It involves risk-taking, decision-making, planning and reflection. Online group work was shown in student responses to be capable of transforming both the learner and the learning experience, and of reflecting how learner needs for time, process and group skills management change as one of the many dynamics of group work.

Data presented in Table Four places online group work as a dynamically negotiated learning process, rather than a one-way dynamic located within in the individual learner. Students relay evidence of 'authentic' interactions between learners and learning events that work to transform both. Kolb's (1984) experiential cycle is a useful referent here, conferring that the important discourse in learning is not always 'declarative and direct'. The experiential cycle supports those who enter the 'learning' of the group for the first time by providing access to the distributed knowledge of its members. Students benefit from exposure to learning opportunities that enable them to observe how others authentically behave, act and perform in a group learning context. These practices seem closer to the more familiar organisational practices of mentoring, modelling and process management. Learners no longer behave like students but as practitioners within the context of their own complex learning environment.

Level Four Evaluation - Value-adding and Student Learning

A level four evaluation measures the bottom line result of enterprise learning, and tries to ascertain whether the learning has had a positive effect on the institution (Kirkpatrick, 1996). Field (1995) identifies the four key components of the new interactive learning paradigm as being an emphasis on communication, a focus on knowledge, the need for an adjustment process to embrace and implement new values, and the flexible assembly of work-ready skills and competencies. It is around these competencies that this final discussion will focus, relaying evidence of how online group work might be adding value to existing learning practices.

Further analysis of the data presented in Table 4 identifies gender specific differences in how students report on learning outcomes relating to online group work. A Chi-square (X^2) test was used to examine whether gender had any impact on satisfaction and reporting of learning outcomes in an online group work context. For female students several significant factors emerged to indicate a change in existing learning behaviours. Female students report that they have learned more about their old friends through the online learning process ($X^2 = 14.80$, $p < .05$), and developed a deeper sense of trust in their online group members as the subject progressed ($X^2 = 12.99$, $p < .05$). They also report feeling more able to speak up in group in an online environment ($X^2 = 12.90$, $p < .05$), despite having felt 'at risk' in an online context at the early stages of group work ($X^2 = 9.49$, $p < .05$). Female students also thought that the online environment was a useful one for highlighting the immature behaviour of some group members and students ($X^2 = 10.72$, $p < .05$), whilst also enabling them to mediate and participate in power struggles within the group itself ($X^2 = 39.69$, $p < .05$).

A common theme in the response of female students is that the online environment creates a more transparent framework for the processing of group work issues. It was considered easier to identify and deal with dysfunctional behaviours online ($X^2 = 13.14$, $p < .05$), to have some fun in a safe learn by doing context ($X^2 = 11.92$, $p < .05$), and to manage group conflict ($X^2 = 17.17$, $p < .05$). In short, female students were able to report an increased capacity to take responsibility for their own learning in an online group work context ($X^2 = 16.97$, $p < .05$), despite acknowledging that this was truly an unorthodox learning environment ($X^2 = 29.85$, $p < .05$).

Male students report a similar, but slightly different pattern of response. Again male students indicate that online group work has helped them to learn more about their old friends ($X^2 = 12.90$, $p < .05$), to speak up in groups ($X^2 = 14.80$, $p < .05$), to develop trust in their peer group ($X^2 = 13.13$, $p < .05$), and to handle and process immature students ($X^2 = 10.72$, $p < .05$). Male students also report a perceived improvement in handling dysfunctional behaviour ($X^2 = 13.14$, $p < .05$), managing conflict ($X^2 = 17.66$, $p < .05$), and in participating and dealing with power struggles within the group ($X^2 = 39.69$, $p < .05$). Learning in online groups is also likely to be fun ($X^2 = 11.91$, $p < .05$), but is also considered by male students to be an unorthodox method of learning ($X^2 = 29.85$, $p < .05$). Online group work also supported male students with planning to complete group learning tasks ($X^2 = 15.26$, $p < .05$). Table 5 summarises the gender specific differences that emerge from the level four evaluation.

Factor	Female X^2	Male X^2	p-value
1. Responsible for own Learning	16.97		.002
2. Feeling at risk as first	9.49		.050
3. Planning Experience		15.26	.021

*significant at $p < .05$

Table 5: Differences in male and female user patterns

While some gender specific differences do exist, these are not extreme, but do touch upon some interesting themes in relation to the epistemology of group work. There is a clear indication in the data that students are forming groups, and working in teams that enable them to develop group facilitation skills and processes. Students are actively engaged in balancing and managing the resource opportunities fellow team members provide, whilst developing strategies to deal with issues of dependability and coordination. The level four evaluation of online group work shows that online communications can both darken the waters of group work (risk factors), but can also provide access to value-adding practices for male and female students that actually improve process management outcomes for all (conflict, dysfunction, power relations, control etc.).

The 'fun' students identify lies in the opportunity online group work creates in allowing group members access to the distributed learning resources of the team, without compelling them to 'buy into' the emotional baggage of group relationships established in short (at times inauthentic) learning contexts. The learning resources for online group work thus become the unique combination of member knowledge and skills. The outcome of such group development is a broad range of experience, personality differences, attitudes and perceptions. The online group environment enables students to isolate aspects of experience, personality, attitude, perception and indeed values, and to deal with these in a way that illuminates both practice and theory. The fact that female students feel more at risk than male students entering online group work, perhaps underlies their determination to take more responsibility for their learning in an online context. This is a tension reduction strategy, that sees female students articulating a need, and then peddling harder to establish themselves in an environment that all students acknowledge as unorthodox. The fact that male students see online group work as particularly useful in addressing their planning strategies is also evidence of the capacity of the online environment to channel a more direct focus on learning and teaching issues, rather than issues of personality and style. This is also evidence that suggests the online group environment provides opportunity for corrective action within the group, thus directing the forming of 'behavioural norms' around aspects of group practice, rather than personality or attitude.

Conclusion: So Why is Online Group Work Less Satisfying than Real Time Groups?

This paper began by examining two cohorts of students, each engaged in the same course of study but using different terms of engagement. Findings conclude that the real time student sample recorded a significantly higher satisfaction rating in some aspects of their group work learning experiences than their online counterparts. Using level two, level three and level four evaluation strategies (Kirkpatrick, 1996) the online group work model was found to be very successful in support group learning behaviours, transfer of these behaviours to practice, and improvement in learner behaviours at the enterprise level. So why was it considered comparatively less satisfying for students?

Online group work is also shown to provide a clinical and experiential learning environment. Its culture promotes an increased sense of responsibility for learning, and for self- and time-management for the learner. Interpersonal issues are still part of the online environment, and it is still punctuated by conflict, member dysfunction, dominant personalities, quiet lurkers, power struggles and accountability issues. Analysis presented here suggests that these behaviours are readily processed online. The online environment is well placed to 'model' group processes as 'something useful in learning'. So why was it considered comparatively less satisfying for students?

This question still remains to be answered, if indeed it can be in the context of this analysis. Perhaps it is the 'joy' of pheromones, or perhaps it is a byproduct of variant sample sizes? Reflecting on the high levels of student feedback and satisfaction, and exploring these through the hindsight and luxury of reflection and research, I remain very positive about the role and potential of strictly online and remote group learning. I have in my mind a compelling picture of Olympic games commentator Bruce McAveny in his call of Kathy Freeman's 400-metre triumph, when he beamed at the camera, and simply said "*How good was that*!" A positive group learning experience is simply that, and comparing one to the other seems like questionable science.

Yet, as Windschitl (1998, p.28) notes, research into the use of online learning environments lacks 'disciplined scholarly articles'. The vast majority of articles published in online learning relate to technology implementation, or serve as reflections of what one or other set of practitioners have done in a range of given contexts. This presents a particular caveat for practitioners of online teaching. The promise of online learning technologies to perform has been largely derived either from observing how others have used them, or through published acts of persuasion. While persuasion is a short-term solution unless accompanied by confirmation, the real benefits from online group work (that is the benefits of group effort and how to work in teams in contemporary organisational settings) will gravitate to the existing pattern of experience unless actively and continuously updated, extended and challenged. The issue here is not really about 'which' is better, but about how group work epistemology can be enhanced through the adaptation and integration of new learning technologies. Results presented here suggest that online group work can make a significant contribution to group learning outcomes.

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SUPPORTING A RANGE OF LEARNING STYLES USING A TAXONOMY-BASED DESIGN FRAMEWORK APPROACH

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Abstract

This paper describes the results of a UK research programme evaluating computer-based learning software and determining its suitability in supporting the different learning styles of users. A design taxonomy is proposed that helps designers build software to target multiple specific learning styles. This enables the courseware to be more user-friendly to a much wider audience, rather than just supporting one type of student. Then an example system is built using the taxonomy, supporting four teaching delivery approaches, and student and designers feedback is analysed to determine the accuracy of the taxonomy.

Keywords

computer-based learning, learning style, teaching delivery approach, simulation, taxonomy

Introduction

Computer-based learning environments are becoming increasingly popular in educational establishments and are based on a range of delivery and interactive services. These services may be composed of many different components, such as: video-conferencing, web-browsers, shared whiteboards, animations and simulations. However, for educational use, these technologies are not mere artefacts whose use is self-evident; they are open to interpretation which can influence both thinking and use (Schreiber & Berge, 1998). Therefore, it is not only important that students are given access to the most appropriate tools and environments that present information in an engaging manner, but that also provide appropriate support for the diversity of individual student learning styles.

Everyone has a learning style. Our style of learning, if accommodated can result in improved attitudes towards learning and an increase in productivity, academic achievement, and creativity. A learning style is a composite of characteristic cognitive, affective, and physiological factors that serve as a relatively stable indicator of how a learner perceives, interacts with, and responds to the learning environment (Messick, 1976). Learning styles also refer to the preferred way an individual processes information. Unlike individual differences in abilities, which describe peak performance, styles describe a person's typical mode of thinking, remembering or problem solving. Furthermore, styles are usually considered bipolar dimensions whereas abilities are unipolar (ranging from zero to a maximum value). Having more of an ability is usually considered beneficial while having a particular learning style simply denotes a tendency to behave in a certain manner. Learning style is usually described as a personality dimension, which influences attitudes, values and social interaction.

If deployment and the outcomes of using Computer-Based Courseware (CBC) are to be maximised then serious consideration must be given to developing applications that can support a range of learning styles. This paper will propose a framework that could help designers and courseware users consider teaching delivery mechanisms that can support such a range of learning styles during the design phase.

Learning Styles

Learning styles specifically deal with characteristic styles and models of learning. There are many definitions of learning styles and a number of these have been identified and studied over the years. Riding and Rayner (1998) identify four distinctly different types of learning style models.

The first ones are those style models based on the learning process and this approach was taken by Kolb (1984) and is referred to as Learning Style Inventory (LSI). Kolb (1984) proposes a theory of experiential learning that involves four principal stages: concrete experiences (CE), reflective observation (RO), abstract conceptualisation (AC), and active experimentation (AE). The CE/AC and AE/RO dimensions are polar opposites as far as learning styles are concerned and Kolb postulates four types of learners (divergers, assimilators, convergers, and accommodators) depending upon their position on these two dimensions. For example an accommodator prefers concrete experiences and active experimentation (CE, AE). There are limitations with this approach according to Riding and Rayner (1998) because it lacks psychometric rigour and empirical studies indicate a lack of verifiability using the measures in a pilot study. Riding and Rayner question whether the model is a description of a specific learning cycle rather than individual differences in the learner. This work was incorporated by Honey and Mumford (1986) in a Learning Styles Questionaire (LSQ) which received a mixed review from researchers indicating variable levels of psychometric rigour, especially in the area of predictive validity.

The second ones are those style models grounded in orientation to study and this approach was taken by several researchers including Entwistle (1981) and is referred to as Approaches to Study Inventory (ASI), also by Biggs (1978) where it is referred to as Study Process Questionnaire (SPQ) and by Schmeck (1988), referred to as Inventory of Learning Processes (ILP). ASI has good levels of empirical data; researchers reported a robust factor-structure with high levels of predictive validity. It provides a more useful tool for researching learning strategies. SPQ does not have as much empirical data to support it but it still provides a useful tool for researching learning strategies. Although there is not very much empirical data to support it ILP appears to carry good levels of reliability and validity; it also provides a useful reference for researching learning strategies.

The third ones are those style models based on instructional preference and this approach was taken by Price, Dunn & Dunn (1976, 1977) and is also referred to as Learning Style Inventory (LSI). The LSI in this context targets the learning environment although it has been criticised by some researchers for not providing data on differences within the learner.

The fourth ones are those style models based on cognitive skills development, this approach was discussed by Reinart (1976) and referred to as the Edmonds Learning Style Identification Exercise. (ELSIE). ELSIE is conceptually significant as a model as it is based upon the idea of field-dependence. Field independence versus field dependence is a learning style which refers to a tendency to approach the environment in an analytical, as opposed to global, fashion. Studies have identified a number of connections between this cognitive style and learning (Kolb, 1984). For example, field independent individuals are likely to learn more effectively under conditions of intrinsic motivation (e.g. self-study) and are less influenced by social reinforcement.

Pask (1975) has described a learning style called serialist versus holist. Serialists prefer to learn in a sequential fashion, whereas holists prefer to learn in a hierarchical, top-down manner.

Howard, Carver & Lane (1996) highlight the benefits from using a range of learning styles when teaching computing students. Such techniques if they were to be incorporated into CBC applications would improve learning outcomes for many students. In a recent research study

(Carswell, Thomas, Petre, Price & Richards, 2000) the authors identify the impact of learning styles using Internet-based teaching mechanisms and claim that the support of a range of learning styles is important in delivering good learning outcomes.

The authors recognise that there are many definitions of learning style in use and have specifically chosen to support a model based on instructional preference for the purposes of this research. It is considered that an instructional preference approach to CBC design offers the user the greatest clarity in making the appropriate choice for their preferred learning style. This decision also places the control of learning approach in the users' hands.

Supporting Learning Styles in Design

Theoretically, learning styles could be used to predict what kind of instructional strategies or methods would be most effective for a given individual and learning task. It is said that optimal learning results when the instruction is exactly matched to the aptitudes of the learner (Cronbach & Snow, 1977).

The requirement to provide a range of teaching approaches was highlighted by Jones (Jones, Jacobs & Brown, 1997) in response to UK Government reports on the impact of technology on teaching and learning (Dearing et al., 1997). Jones et al., (1997) state: 'Clearly developing a single piece of courseware which simultaneously provides guided sequential learning for one set of students and discovery-based exploration and browsing for another, together with a range of hybrid options for those learners who may prefer a mixture of the two, is a demanding task, though not an impossible one for the future, and even, given the flexibility of current technology, to some extent for the present.'

In a research report (Bates, 1998), the author describes in detail the characterisation method and taxonomic framework in building a real example: a series of control laboratory experiment applications. In this example, four different teaching delivery approaches were chosen and characterised using five primary classification issues. These were:

- Drill experiment;
- Tutorial experiment;
- Simulation experiment; and
- Modelling experiment.

By considering these four teaching delivery approaches, a diagram was constructed to show how the level of interactivity varies according to the level of student control, see Figure 1. This shows that the four teaching delivery approaches include guided sequential and discovery-based student exploration as required above.

<table>
<tr><td>High Interaction</td><td colspan="2"></td><td colspan="2">Modelling Simulation
(Discovery Learning)</td></tr>
<tr><td>Some Interaction</td><td></td><td colspan="2">Tutorial
(Guided Sequential Learning)</td><td>Interactive Simulation
(Guided Discovery Learning)</td></tr>
<tr><td>Low Interaction</td><td colspan="2">Drill
(Sequential Learning)</td><td colspan="2"></td></tr>
<tr><td></td><td colspan="2">Teacher Controlled</td><td colspan="2">Student Controlled</td></tr>
</table>

Figure 1: How each teaching delivery approach affects interaction

Design Approach Framework

The emergence of desktop multimedia personal computers and the general availability of multimedia authoring packages have enabled educationalists and commercial organisations to produce

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more CBC. Even before this recent change in general availability of technology, researchers such as Bialo and Erickson (1985) were highlighting problems in CBC. Their research covering 163 applications identified basic problems such as clarity of learning objectives, appropriate goals and content, appropriateness of software for particular users and a general lack of supporting materials. Harrison (1994) states that learning technology should be more concerned with the design of the whole learning experience rather than an emphasis on a particular learning delivery medium.

In a research report the author (Bates, 1998), described a taxonomic design approach to developing computer simulated experiments which included a series of trials of a software demonstrator designed using the taxonomy as an explicit design guide. The research identified five primary characterisation issues, which can determine the profile of a teaching delivery mechanism. These were goals, guidance, interaction, instructional process and modelling complexity.

Goals are concerned with identifying what level of goal setting is possible and whether the user has any freedom in setting the learning goals for a particular application. The characterisation process seeks to determine if goals relate to individual tasks, complete topics, overall learning objectives or can they be determined by the user.

Guidance is concerned with specifying what level of application support the user receives when interacting with an application. Such support can range from simple confirmation of right/wrong answers to questions, prompting to give clues when wrong answers are given, through to complex responses to changes of user variables in the user interface.

Interaction seeks to determine what level of interactivity is possible with the user interface. This ranges from yes/no questions, to experimenting with values, multiple variable assignment, through to users supplying their own simulation model.

Instructional process ranges from a user solving an individually distinct problem, identifying concepts or rules, discovering a best strategy to solve a problem, discovering optimal values for several variables, through to applying knowledge acquired in a particular area through the use of an evaluation or modelling technique.

Modelling complexity characterises the type of model the user will interact with directly or indirectly when using the software. This affects such things as the number of variables changeable at the user interface through to the complex interaction with the system with users' own models.

These five primary characterisation issues were then used to characterise the four different teaching delivery approaches described earlier. Table 1 shows the characterisation categories.

	Primary Characteristic Issues (determine teaching delivery approach)			
Characteristic Category	**Lowest Complexity**	**Low Complexity**	**High Complexity**	**Highest Complexity**
Goals	Task	Topical	Overall	Definable
Guidance	RightWrong	Prompting	Outcomes	Directive
Interaction	Simple	Experimental	Multivariable	Engaging
Instructional	Discrete	Conceptual	Strategy	Embracing
Modelling	None	Singular	Multiple	Complex

Table 1: Categories and levels of characterisation issues

Each characteristic issue is divided into sub-characteristics. It is the presence or absence of these sub-characteristics, which uniquely define a particular environment; be it Drill, Tutorial, Simulation or Modelling. The detail of each of these can be seen in Table 2 which shows a summary of which primary characteristics were embedded in which particular teaching delivery approach. The profile of primary issues has been set to characterise the four teaching approaches chosen: Drill, Tutorial, Simulation, and Modelling.

Category	Sub-Category	Drill Experiment	Tutorial Experiment	Interactive Simulation Experiment	Modelling Simulation Experiment
		TEACHING DELIVERY APPROACH			
Goals	Definable			YES	YES
	Overall			YES	YES
	Topical		YES		
	Task	YES			
Guidance	RightWrong	YES	optional	optional	optional
	Prompting		YES	optional	optional
	Outcomes			YES	optional
	Directive				YES
Interaction	Simple	YES	optional	optional	optional
	Experimental		YES	optional	optional
	Multivariable			YES	optional
	Engaging				YES
Instruction	Discrete	YES	YES	optional	optional
	Conceptual	YES	YES	YES	YES
	Strategy	YES		YES	YES
	Optimal			YES	YES
	Embracing				YES
Modelling	None	YES	YES		
	Singular	YES	YES		
	Multiple			YES	YES
	Complex				YES

Table 2: Taxonomy characterisations for primary design issues

Description of Software Package

The software was developed using a commercially available software tool (Asymetrix, 1994). The system was divided into four major sections: Tutorial, Drill, Simulation and Modelling. Two underlying analogies were used to provide a background for students to study. The first was the analogy of a water tank with a leakage factor proportional to the height of water in the tank. The control goal was to maintain the height of water in the tank by controlling the inflow of water. In the second case the analogy was of a room, heated by an energy source, which loses heat proportional to the difference between the room and the outside temperature. The control goal in this case was to maintain the inside temperature of the room by controlling the flow of energy into the heater.

The flow of this approach can be seen in Figure 2. The main menu, see Figure 3, enables users to select the control analogy and the learning environment required (e.g. Drill etc.). Upon selection of the appropriate button the user will then enter one of the four learning environments.

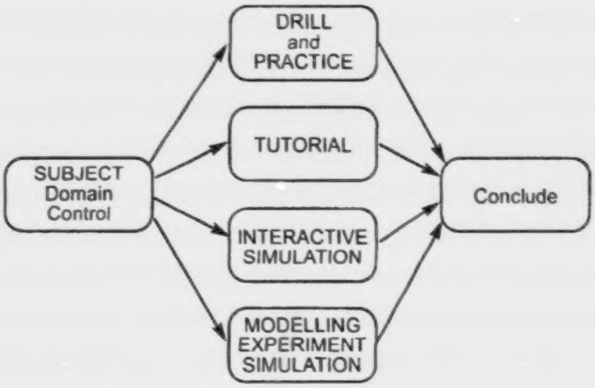

Figure 2: Choosing teaching approach path

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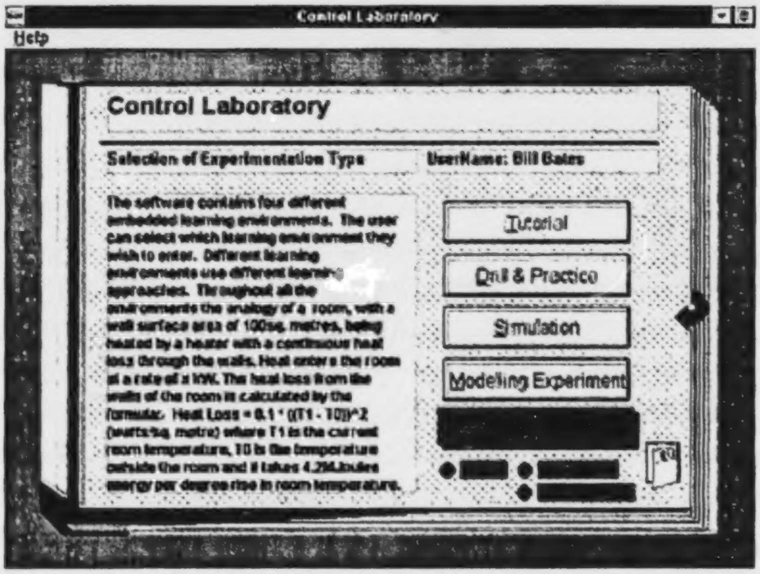
The Tutorial environment contains four major sections; Principles of Control, Designing Control Systems, Systems to be Controlled and Methods or Modes for Control of Closed Loop Control Systems. These sections all have a series of information screens with an access button to Self Assessed Questions (SAQ) to test the user's knowledge of the subject material they have covered in the current section.

The Drill and Practice environment contains five pages of different yes/no answer drills. The idea is to test the user's knowledge of the subject by only asking single answer questions. The Simulation environment is the first occasion where the user will meet a simulation process explicitly, although the simulation engine is embedded in every environment of the software. Figure 4 shows a typical open loop simulation run. Users can vary parameters and perform user defined simulation runs. The Cfg button allows users to change the control algorithm used as well as change the outside temperature for the heated room analogy. Users can print a hard copy of any of the graphs plotted by the simulator.

The Modelling environment allows users to perform simulations and transfer the run-time parameters to a Dynamic Data Exchange (DDE) linked spreadsheet and compare their own developed model with the one embedded in the Control Laboratory software. This particular environment is the most sophisticated learning environment supported by the system. The results are imported from the spreadsheet and plotted on a composite graph.



Selection of Experimentation Type

UserName: Bill Bates

The software contains four different embedded learning environments. The user can select which learning environment they wish to enter. Different learning environments use different learning approaches. Throughout all the environments the analogy of a room, with a wall surface area of 100sq. metres, being heated by a heater with a continuous heat loss through the walls. Heat enters the room at a rate of x KW. The heat loss from the walls of the room is calculated by the formula: Heat Loss = 0.1 * ((T1 - 10))^2 (watts/sq. metre) where T1 is the current room temperature, 10 is the temperature outside the room and it takes 4.2MJoules energy per degree rise in room temperature.

Figure 3: Control laboratory 'main menu'

Results and Evaluation

Field trials of the software demonstrator were conducted using a user questionnaire incorporating the taxonomy characterisation described in Table 2. The sample population used consisted of a group of 30 students and lecturers. The researchers analysed the results to answer three fundamental research questions:

how consistent is the taxonomy perceived by a range of users;
can the taxonomy differentiate across the four different teaching approaches selected; and
how visible are the designer's intention to users.

The purpose of doing such a questionnaire survey was to check the visibility of the different

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characteristic issues to users and to evaluate the consistency of results over a sample population against the original design intentions.

The survey and full results are detailed in Bates (1998). The results of the survey were analysed using three different statistical analysis methods. The first method was the *t-test*, which was used to test for consistency over a range of users. The second method was a one-way ANOVA, which was used to check that the different teaching approaches (Drill, Tutorial, Simulation, and Modelling) were significantly different from each other. The third method was a simple comparison of statistical mode, between the designer's intention and the users' perceptions.

The characteristic category Goals proved not to be consistent and more work needs to be done to develop Goals by reviewing the characterisation criteria and extending the demonstration software to incorporate a wider range of characterisations. Guidance revealed some misunderstanding between Drill and Tutorial as students found it difficult to differentiate these two approaches. Tutorial approach differs from the Drill approach in as much that feedback it provides to users is more helpful and informative. In general, with the exception of the above limitations, the quantitative research activity confirmed that the proposed characterisation process and taxonomy was consistent to a wide range of users, accurate in differentiating between applications approaches and users were able to identify, in most cases, the original designer's intentions.

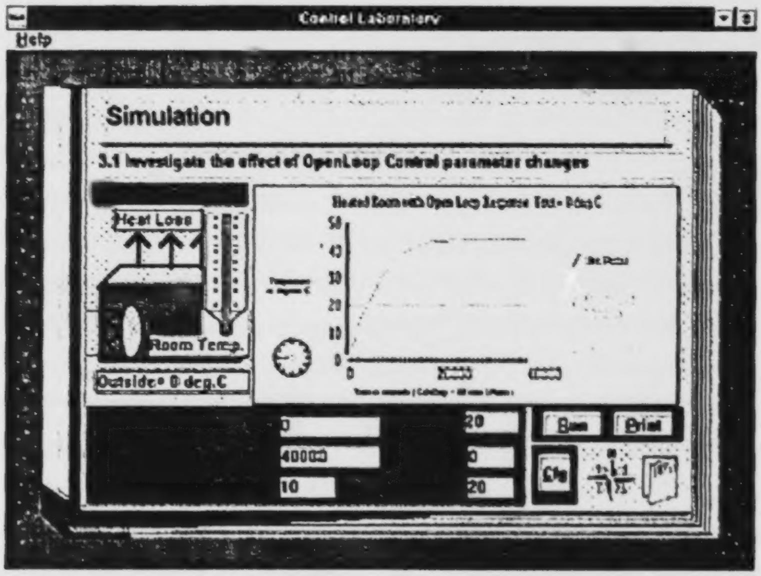

Figure 4: Control laboratory 'simulation menu'

The experience from designing the demonstrator led the researchers to construct a flow diagram to illustrate how the taxonomy can be applied to designing educational software, see Figure 5. Four out of the six stages of the proposed design process involved using the taxonomy directly. These were: Specification (identifying learning approaches required), Interaction (deciding on appropriate user interaction strategies), Analysis (analysing the design from a developer's perspective) and Evaluation (evaluating the user perceptions).

Conclusions and Future Work

This paper has highlighted the need to develop software for CBC environments that is capable of supporting a range of student learning styles. It has shown that there are some distinct advantages in using a taxonomic driven design and evaluation approach, which gives clear guidance to designers

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wanting to develop software to support a range of learning approaches. However there are a number of limitations in the taxonomy characterisation presented, which need to be addressed in future research work. The characteristic Goals was the most difficult to categorise. The quantitative research analysis revealed problems when evaluating the software demonstrator. This would indicate that these issues need to be more carefully embedded into an application. This work did not address the area of collaborative or co-operative issues, which are becoming increasingly important especially in a distance-learning context. The software demonstrator developed was for a specific subject domain (control engineering) and whilst this was quite mathematically demanding it would be useful to develop further demonstrators to see if this approach could be applied in other more generic teaching and learning contexts.

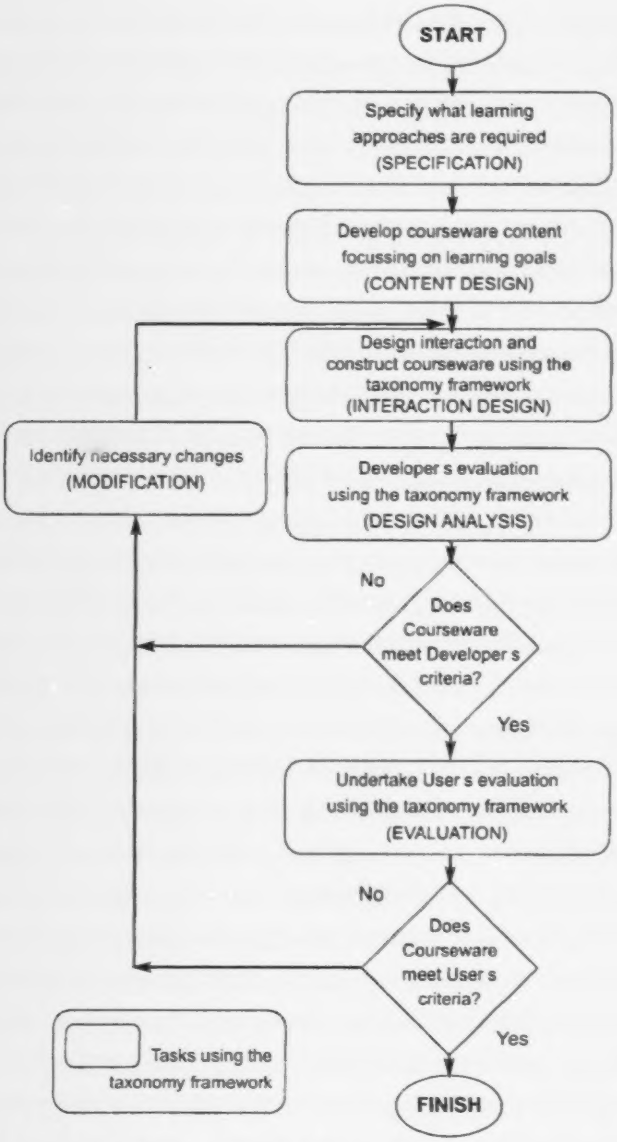
START
Specify what learning approaches are required (SPECIFICATION)
Develop courseware content focussing on learning goals (CONTENT DESIGN)
Design interaction and construct courseware using the taxonomy framework (INTERACTION DESIGN)
Identify necessary changes (MODIFICATION)
Developer s evaluation using the taxonomy framework (DESIGN ANALYSIS)
No
Does Courseware meet Developer s criteria?
Yes
Undertake User s evaluation using the taxonomy framework (EVALUATION)
No
Does Courseware meet User s criteria?
Yes
Tasks using the taxonomy framework
FINISH

Figure 5: Flow and use of the taxonomy

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SEEING THE BIGGER PICTURE: EXPERIENCES OF EMPLOYING ONLINE LEARNING WITHIN TAFE AT RMIT

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Abstract

This paper explores some of the challenges of a large cross-sectoral university and considers how online learning has enabled one TAFE department to become more fully engaged in the wider university context.

Keywords

TAFE, institutional policy, cross-sectoral university, cultural change

A University of Technology: TAFE and Higher Education

Since RMIT University opened as the Working Men's College in June 1887, there has been a strong focus on providing opportunities for students to prepare themselves for employment, whether it be in specific trades or in broader professional roles. Reports such as OTFE (1998) provide clear evidence of the link between a healthy economic sector and investment in appropriate training. Since the mid 1990s, there has been a commitment at university level to the development of a close relationship between the TAFE (Technical and Further Education) and higher educations sections of RMIT University.

The Australian Vice Chancellors' Committee (1997) is clear in its support for the benefits of cross-sectoral collaboration. They note the need for "a diversity of responses from both within universities and within TAFE to provide the flexibility needed to stimulate life-long learning and develop a highly skilled workforce". They outline the benefits of interaction between TAFE and universities as including:

- "diminution or eradication of the need to cover subject content in higher education already learned in VET;
- savings in time and cost in formal study for the student;
- 'second chance' opportunities to gain university qualifications, especially for mature-aged students;
- the ability to market joint programs overseas; and
- working together in areas where there is commonality or complementarity of objectives, universities and TAFE can assist each other in meeting their own objectives more effectively and in serving the community better."

The Australian Qualifications Framework (online) shows how TAFE and higher education qualifications are related. In an outcomes-based curriculum framework, TAFE qualifications are increasingly based on Training Packages, defined by the Australian National Training Authority as "a consistent and reliable set of nationally endorsed standards and qualifications for recognising and assessing people's skills. A Training Package describes what skills and knowledge you need to perform effectively in the workplace without prescribing how you should be trained" (online). There are currently 66 Training Packages, all based on industry-defined competencies. The difference between Training Packages and traditional TAFE curriculum specifications is that there is increasing flexibility in methods of teaching and assessment. There are learning pathways and guidelines but a prescriptive lock-step approach to training no longer exists as official policy. Increasingly, the use of technology is seen as providing tools to make use of this increased flexibility.

The theory of cross-sectoral collaboration is fine. How does this work in practice? Are TAFE and higher education staff really equal partners? Ramsey, Tranter, Kain and Sumner (1997) reported on cross-sectoral linkages at the University of South Australia. Their comments reinforce the 'vision' at the top that may not be matched by the reality at the coal face: "There is a strong commitment at the senior leadership level to the principles of credit transfer and recognition of prior learning. However, this commitment is not yet reflected across the wider University community." In many cross-sectoral institutions there is a continuing cultural divide between TAFE and higher education, often not articulated and hence often quite hard to bridge: training as being inferior to education; TAFE staff as less qualified than higher education staff, etc.

In this paper we will examine how online learning has been used within one TAFE department at RMIT University. Has the advent of a more open TAFE curriculum framework, together with access to the use of technology at RMIT, brought tangible benefits to the department? The Department of Health and Biosciences is the only TAFE department in the Faculty of Life Sciences at RMIT where there are six higher education departments. There is a strong interest in scholarship in the department (approximately 40% of the staff have higher degrees). There is a sense of sharing ideas at a local level with other staff in the faculty but no specific collaborative projects. Staff report a sense of being 'forgotten' in faculty policy discussions. In discussions, one gets the sense of a department 'almost' in the faculty.

Unlike other TAFE institutions, at RMIT, the TAFE sector is integrated within the university system, and many educational initiatives introduced to higher education are also implemented within the TAFE framework. Over the past few years, RMIT has made a substantial investment into the use of technology (e.g. see Fallshaw, 2000). This initiative, called the IT Alignment Program (ITAP) involves investment in infrastructure, enterprise computer-based systems, Library resources, staff development, and program and course renewal (Note that RMIT, like several other Australian universities, has adopted the nomenclature of programs and courses: program for the university's provision of an entire student educational experience leading to a formal qualification and course for the component subject, unit or module.) (online). Funding for course renewal is seen as a high priority both for higher education and TAFE, and access to online resources and support is the same for both. This is seen as an important step for TAFE and higher education because it is believed that a more coordinated and synergistic effort can be created through sharing experiences and expertise that would otherwise be lost if the two sectors were separated in this renewal initiative.

Reasons for Engagement: Pedagogy or Compliance?

It is not easy to determine how rapidly teachers are likely to take up online learning strategies. In a recent investigation into the factors supporting the adoption of computer-facilitated learning (CFL) at Australian universities (McNaught, Phillips, Rossiter & Winn, 2000), three major themes emerged. These were *Policy*, *Culture* and *Support*. There is considerable overlap between and within these themes. There needs to be a congruence of policy, culture and support factors if significant adoption of CFL strategies is to occur.

Ultimately, to make online learning a successful tool for the real or virtual classroom requires that teachers understand the place of online learning within the overall RMIT Teaching and Learning strategy (online). With the rush of information technology currently being researched and used in a variety of areas, many teachers, and students, are left confused as to how online education fits into the overall scheme of things. Are these online tools really useful for learning? Is this another RMIT fad? Just another funding hoop we have to leap through? Or even more threatening, is the IT 'revolution' simply a precursor to 'redundancy' for teachers?

Many teachers, and indeed students, in the Department who have been accustomed to teaching and learning with current materials and resources are generally unsure as to how online learning can feasibly benefit education. Apart from the acknowledged ability of web-based materials to be time-flexible, and provide a graphics-user-interface that is aesthetically pleasingly, most staff and students are, initially, unable to see the bigger picture of the online learning revolution past the 'whizz-bang' entertainment value. Furthermore, because of the sophisticated software and hardware that is constantly being expanded and updated, apprehensions abound as to the why, where, what and how to implement the 'unknown' online learning environment within the 'known' face-to-face teaching and learning paradigm. How do student contact hours (the way in which the length of TAFE courses are currently measured) translate into learning specific competencies, both online, in the classroom and in the workplace?

All these questions cannot be treated philosophically or demonstrated theoretically, because, inevitably, the people who have to use the technology and make it work are the people who probably understand the complexities of it the least, that is, staff and students, compared to the people creating and evolving online learning education. The education of teachers and students in online learning is a gradual process and major steps are being made to that effect. However, there are still many staff who have little experience with IT, especially web-based learning, and even less experience at understanding the role of online learning in education. To overcome the initial barriers of apprehension, and to plant the seeds of creativity, online learning was introduced to staff, not as a distinct entity separate from the overall teaching-learning strategy, but as an integral part of it. That is, any implementation of online learning was seen as a part of the entire teaching program and not a separate or supplementary component.

One of the most important aspects of the online initiative in the Department of Health and Biosciences has been the active support of the Head of Department, who sees the new technology as vital to the development of the TAFE sector, and TAFE teachers, to meet the demands of industry.

Anatomy Online

The Learning Hub environment, developed by the Distributed Learning System (DLS) at RMIT, (e.g. see McNaught, Kenny, Kennedy & Lord, 1999) using a suite of online tools (chiefly Courseinfo/Blackboard), can be used by teachers to allow students the opportunity for self-directed learning. For example, in early 2000, under the direction and support of the DLS, an anatomy development site for the Myotherapy program was created in the Learning Hub as part of the Learning Technology Mentor (LTM) program (McNaught & Kennedy, 2000). The site was designed to be used as a prototype for teaching other staff members the framework of the DLS, and demonstrating online learning and teaching strategies.

Building the Course

One of the biggest difficulties in planning what to create for an online learning environment is trying to limit the almost endless material one can use. There are literally hundreds of applications and ways of creating a suitable online environment and it is very easy to become immersed in it all, leading from too much 'playing around' with software to outright confusion and bewilderment. Thus, from the very beginning, a strategic online learning plan was to be clearly set out and thought through in order to focus the aim on the specific needs of the course, students and teachers.

One approach to thinking about implementation of online courseware was to ascertain the way in which it should be used in the TAFE sector, and the logistics of employing it. The strong vocational emphasis in TAFE requires a substantial oral tradition to relay an understanding of the relevant industry characteristics to students. That is, TAFE courses are designed with a large practical component that is ideally transmitted through the experience and expertise of staff. However, most industries are rapidly advancing in their use of information technology, and thus, TAFE students require to be taught the practical application of online technologies. Three fundamental principles were used for TAFE as a starting point for online development:

1. **Keep it simple:** Because online learning is relatively new to TAFE (staff and students), software and hardware should be kept as 'user friendly' as possible. Also, reliability is an issue because if students and teachers are unable to access resources promptly, this makes using online learning a frustrating experience.
2. **Use online learning for what you can't achieve with other resources:** This means that 'data-dumping', i.e. placing large files of text in any format on the DLS is not desirable. Simply putting a textbook online is ineffective use of resources, and from an ergonomic perspective, having students sitting at a computer reading screen after screen of text is not a healthy or sensible strategy.
3. **Employ strategies to encourage students to use the online resources:** Human nature being what it is, if the students can get away with not doing certain tasks, they will! By giving students a reason for accessing online resources that is perceived as beneficial to themselves, then the likelihood of them using it effectively, and learning something from it, is greatly increased.

In the anatomy course, the DLS was an ideal environment because of its easy-to-use template of Courseinfo/Blackboard software that provides a stable backdrop for the teacher-student online experience. All enrolled students can access the Learning Hub environment to gain entry into their specific courses using a simple menu format that can be easily recognisable, even by first time users. The broad lay-out and effective use of graphics, that is similar across all courses developed in the DLS, makes the experience pleasant and familiar, and free from 'unwanted noise' such as subtle advertising that seems to be increasing in many open educational websites. The DLS, in general, is quite reliable, and with its simple user-interface, creates a friendly environment for the student and teacher to work in.

Format

The basic format of the anatomy course using the principles cited above (especially principle number 2), are developed in accordance with the software template. There are various on-screen 'buttons' which students can access once they have gained entry into their enrolled course that direct them to specific online activities or information. All of these areas have been used. A description of these buttons and their significance follows:

- **Announcements**: this button is a great way for the teacher to disseminate information concerning class timetables, schedules, change of lab times, etc., that would normally take a lot longer if the teacher had to pin these things up on the local student notice board. For the anatomy course, announcements of these kinds are updated and posted immediately, and are used as an initial way to encourage students to access the online course frequently.
- **Course Information**: the teacher can easily update information relevant to the course, such as course guides or outlines, for student access. Specifically, this area contains all information regarding week by week learning outcomes for the student.
- **Staff Information**: students have access to a picture, and a basic history or curriculum vitae about the teacher managing the anatomy course. This can help to instil confidence in students because, generally, most are hesitant about asking questions concerning teacher history. Nonetheless, it is important for the student to feel as though they are being taught by qualified staff.
- **Course Documents**: only documents that cannot be found elsewhere were to be placed into this button. These included concise anatomy notes derived from class discussion which were posted here. Once again, the principle of limiting text to a minimum was to be observed. Also, if certain documents are to be placed online, this gives the student an opportunity to download or copy these files into a format of their choice in order to either add or subtract information according to their particular style of learning. Thus, a sense of student empowerment can be achieved.

- **Assignments**: this is the most essential area because it contains quizzes and/or surveys developed by the teacher specifically for the course. The teacher can create multiple-choice, true/false, ordering, matching, fill-in-the-blank, and short answer based assessments designed to informally examine the student. These assessments have in-built feedback processes that allows the students to immediately know their results under timed conditions or repeated attempts. This is ideal for students, especially in anatomy, because they can better gauge teacher expectations from such a diverse subject. Also, the teacher is relieved from extra marking duties, and once the assessment(s) has been created it manages itself to the advantage of the teacher and student.
- **Communication**: this is where the teacher can set up forums in the discussion board or use virtual chat areas to increase the willingness of students to use online material. This gives students the chance to interact and communicate in a different medium than the classroom that has the added advantage of increasing the opportunity for students to think about what they say by putting it into written form. Also, it helps to build a sense of ownership in the online learning experience by allowing the student to actually see how they contribute to the learning development of the course site. This is important if students are to be encouraged to participate willingly in trying to understand concepts in anatomy, rather than regurgitate volumes of facts. The wording of discussion topics is important in order to engage students. For example, two topics currently under discussion are:
  * The skeletal system is piezoelectric, meaning that, with deformity, bones will produce an electromagnetic current, and, exposing bone to an electromagnetic current will deform it. What implications does this have?
  * How important is understanding the client's psychology, as well as one's own, in myotherapy practice?
- **External Links**: students and teachers can participate by placing relevant website addresses in the course, saving student research time, and once again, allowing the students to actively participate in the development of the site. The websites chosen are based on different anatomical approaches to similar problems.
- **Student Tools**: extending the theme of ownership, this button is dedicated to the student as a place in the course that is theirs to use and develop according to their own initiative.
- **Resources**: a smaller button located below all the other buttons is automatically configured to course specifics (the health sciences, specifically, medicine) when the teacher is in the process of developing the site. It gives the student an opportunity to research information that is geared specifically towards their particular area. Therefore, the students have no excuse not to be able to gain access to readily available research information.
- **CONTROL PANEL-Course Statistics**: this button can only be accessed by the teacher and has the advantage of providing information concerning a statistical analysis of course use. For example, the teacher can generate a report presenting information on when and what areas of the course were accessed. The teacher can use this information to further develop the course by adding or subtracting parts that are or are not being used effectively. Individual students visits are recorded to give the teacher an indication of who is actually using the website, and a summary of individual assessment results can be generated by the assignments area. This helps in judging student progress and gives an opportunity for early intervention for 'at risk' students.

The end result of implementing the online learning strategy in this way is that teachers can reduce the amount of 'fact giving' and 'note taking' in class. This can now be the responsibility of the student because they have 24-hour access to specific information and assessments relevant to the course that was developed by the teacher. Furthermore, it frees up the teacher's time in class for actually performing the role of a teacher. That is, the students have more access to the teacher's experiences and practical advice in attempting to understand issues in the workplace or industry by allowing an increase in teacher-learner interaction. Thus, in one respect, it provides the learner with an opportunity to deepen the understanding of their topic by enhancing the oral tradition of teaching that is so important in TAFE, while simultaneously offering an avenue for self-directed learning that is becoming more significant in the workplace. Also, it provides teachers with the chance to be more creative with their oral presentations in class, and their online presentations in the DLS. Overall, if used appropriately, the online learning experience can supplement, complement, and replace those areas of learning that students can perform individually while utilising the experiences and aptitudes of staff more effectively.

Student Learning

Does this all work for students? The anatomy course site is part of the Myotherapy program in the Department of Health and Biosciences (online). The program is structured so that four times a year staff-student feedback meetings are held. These meetings, which are well attended, allow students and staff an opportunity for constructive criticism towards the aim of improving the quality of teaching and learning, and the overall evolution of the course. A pilot study for the Anatomy 2 course was conducted during semester two of 2000 using first year students with positive student feedback at meetings, surveys and discussions. Table 1 shows the access statistics for the pilot in 2000.

Area Type	**Visits**	**Percent**
Content Areas (inc. quizzes)	1384	81.9 %
Communication Areas	95	5.62 %
Group Areas	1	0.05 %
Student Areas	209	12.3 %
Total	1689	100 %

Table 1: Statistics for second semester, 2000, for Anatomy 2: Pilot with 50 first year students

It is interesting to compare these figures with those for another group of 50 first year students, not doing a pilot but as 'normal' students in first semester 2001 (Table 2). The site is used much more, but the ratio between areas remains essentially the same.

Area Type	**Visits**	**Percent**
Content Areas (inc. quizzes)	5054	88.4 %
Communication Areas	284	4.97 %
Group Areas	3	0.05 %
Student Areas	358	6.26 %
Total	5711	100 %

Table 2: Statistics for first semester, 2001, for Anatomy 1 with 50 first year students

This is a fairly normal pattern for many courses at RMIT. Despite the fact that we seek to emphasise communication and student-initiated construction, there is no doubt that accessing resources and specific exercises is still the main reason students go to online course sites. We intend to monitor this over time to see how the pattern changes as staff become more skilled with online design and students more comfortable with the environment.

Following the pilot in second semester 2000, a completely developed online site was employed with first, second and third year students in semester one of 2001.

The main criticism against online learning from students was the frequent errors in using user-names and passwords to gain access to the DLS. In most part it was due to the various hiccups in central operating procedures on behalf of the DLS, that have now been rectified, but also many of the students were not careful enough when entering passwords or user-names, considering that they are case-sensitive. However, once these problems were solved, most of the criticisms came from students who did not wish to have a change in the mode of course delivery. These students did not criticise the content of the course; they just wanted to continue with the face-to-face classes they had grown accustomed to. It takes a long time for some students to change their preferred ways of learning.

For example, the third year students who were used to the traditional ways felt that the implementation of online learning was 'too much' to handle, mainly because of the initial accessibility problems, but the attitude expressed was one of 'resistance to all things new'. That is, they view online learning as extra work and a hindrance to the previous ways of learning. Comparatively, the attitude by the second, and especially the first year students, was more positive and less critical than the third year students, revealing that they perceived that online learning was an acceptable part of a learning environment. However, what was universally agreed upon was the advantage of accessibility to specific resources that could very quickly be updated. This was especially emphasised in relation to the Assignments and External Links sections that the students felt was very beneficial to study.

As a spin-off to using online learning, the students' computer and web-based skills significantly increased. This was mainly due to students assisting each other in accessing information or helping with menu options. This was unforeseen but proved to be a practical way that students could increase student-to-student interaction while simultaneously acquiring skills beneficial for their future careers.

Impact on Colleagues

Initially, staff were apprehensive about engaging in online learning because they felt that it would be extra work forced upon them by the hierarchy that they deemed not being relevant to the business of teaching. However, with the support of the Head of Department and the prototype of the Myotherapy anatomy site, it was demonstrated how online learning could be a valuable tool in the ever-increasing teacher tool-box. Once the site was up-and-running there was very little maintenance required by the teacher; this allows plenty of work to be conducted by the student with reliable and accurate feedback for both parties concerning the validity of the course. However, it is crucial that support come not only from the University, and specifically the DLS in this case, but also by the people directly overseeing the process; that is, the Head of Department and the specific online learning educator, or in this case the Learning Technology Mentor. A comfortable environment whereby teachers can affordably make mistakes and receive responsive assistance is essential to allow any creative process. Also, once the teachers experienced for themselves the user-friendliness and application of online learning, to their credit, they took up the challenge with a positive attitude. There are currently 20 courses in the DLS, 14 of them live and the rest under development. At this stage, about half the Department staff are engaged in or about to embark on online learning, about the same proportion as in other higher education Departments in the Faculty.

How does this assist with TAFE/higher education synergies? The fact that this department has active and successful online courses is tremendously important in the Faculty. At Faculty forum events, there are now specific courses to showcase. Also, the Department is now well placed to engage in faculty-wide projects. It is early days but, in life sciences, the development of suitable digital visual resources is a major challenge for the development and enhancement of online learning. The Department of Health and Biosciences now has a skill base and experience to engage in these projects as they arise.

Conclusion

The experience of this department is that practical implementation of online education is a positive initiative. It requires educational support and encouragement from IT support staff, centrally and at faculty level. It clearly has university policy support but this needs to be actively reinforced at a local level by the Head of Department. Overall, the departmental staff have embraced the new technology to develop the TAFE sector, and TAFE teachers, to meet the demands of industry.

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A CASE STUDY OF AN ONLINE ROLE PLAY FOR ACADEMIC STAFF

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Abstract

Role play is a powerful technique for skills and attitude development. It is now possible to combine the advantages of face-to-face role play with the potential of the online environment. This paper reports on a case study of an asynchronous, anonymous, online role play conducted within a teaching course for academic staff. Findings suggest that online role play may offer an effective learning process and that anonymity may be a key factor for participant involvement and comfort. However the online environment may decrease role engagement and cultural and language factors may affect participant involvement.

Key words

online, role play, academic development, anonymity, asynchronous, WebCT

Introduction

Role play has long been recognised by teachers and trainers as a powerful technique for skills and attitude development in the face-to-face environment (for example, Carroll, 1995; McGill & Beaty, 1995; Gredler, 1994; Turner, 1992; Eitington, 1989; Craig, 1987; Ladousse, 1987; Shaw, Corsini, Blake, & Mouton, 1980). As the use of online discussion tools within university courses continues to grow, the idea of combining the powerful learning possibilities of role play with the potential of the online environment is receiving attention. The concept of asynchronous, anonymous role simulation as a learning activity is of great interest to academics and trainers (Freeman and Capper, 1999). Various reports of online role play, simulation and role simulation as Freeman and Capper (1999) term it are appearing (for example, Ip, Linser and Naidu, 2001; Wills, Ip, and Bunnett, 2000; CAUT projects by Andrew Vincent and Penny Collings reported by Alexander and McKenzie; 1998). This paper reports a case study of an online role play and explores some key issues that have and emerged from the findings.

Background

The consideration of new learning tasks that become possible with new technologies should be part of the educator's strategic learning plan (Freeman and Capper, 1999). The writer thus decided to design and implement an online role play as an interactive learning activity within one module of a teaching course for academic staff at an Australian University. Previously, completion of the module had required participation in a face-to-face workshop and completion of an independent study handbook. The online role play was designed to trial an alternative to the existing face-to-face workshop that might offer more flexibility of access for participants and provide an opportunity to explore various approaches to a contentious topic within the course.

Sixteen participants were divided into two groups of eight participants each and given the same directions, information and role statements. The role plays were set up within a WebCT bulletin board and ran for five weeks, during which participants were expected to contribute to discussion from the viewpoint of the role they were playing. At the end of the role play participants were given access to the postings from both role plays and the contributions were discussed. Marks were not allocated to the role play, although a specified level of participation was a requirement for course completion.

Evaluation Methodology

The evaluation methodology was grounded in the interpretive paradigm, the central endeavour of this paradigm being "to understand the subjective world of human experience" (Cohen and Manion, 1994, p. 205). Case study method was utilised, in which the researcher 'observes' aspects of individual or group activity in order to "probe deeply and to analyse intensively the multifarious phenomena with a view to establishing generalisations about the wider population to which the unit belongs" (Cohen and Manion, 1994, p. 106-107). In this case study the role play moderator is a "participant-observer" (Cohen and Manion, 1994, p. 107), participating to some extent in the activity being evaluated.

To determine the effectiveness of the role play activity the moderator analysed the descriptive accounts (postings) and the face-to-face discussion responses. Participant responses to the activity were also evaluated by questionnaire using closed questions on a four point scale from strongly agree to strongly disagree, with provision for open comments. The questionnaire and discussion covered the effectiveness and purpose of the role play; feelings about taking part; anonymity; and role engagement. Eleven of the fourteen participants completed the questionnaire and participated in the discussion. (Initially sixteen participants were allocated roles but two left the course.)

The Role Play

Description and Purpose

The educational purpose of the online role play was to support course participants in exploring a key, controversial educational issue for academic staff – whether to use norm referenced or criterion referenced assessment. A further purpose was to support participants' orientation to the university by having them interact with various roles within the wider university community and in this way become more aware of the wider context in which decisions are made within universities. A third purpose was to develop their skills in the use of online teaching technologies.

The role play was designed to provide participants with a realistic forum to discuss the issue – the letters column of a supposed local newspaper, the *Daily View*. The role play took place at a mythical university called *Idontgoto* University in which criterion referenced assessment had been used within a subject. All students had achieved 100%. Participants discussed the merits of norm referenced and criterion referenced assessment through letters to the editor on the bulletin board.

Each participant was allocated an Idontgoto University role within one of the two groups. Roles were: Vice Chancellor; Pro Vice Chancellor (Academic); Superi Or, a high achieving, high distinction student; Medi Um, a low achieving, pass grade student; Concerned Citizen; Faculty Member; Dean of Students; and Chair of the Student Representative Council.

Only the moderator knew which role each participant was playing and participants were not able to access the other group's discussion. Roles were allocated alphabetically according to surname except for one group of three participants from the same department who were split between the two groups. Participants in both groups were provided by email with the same scenario and directions.

Participants were required to monitor the bulletin board at least once each week over four weeks and respond in character to the postings. Postings were expected to make a significant in-role contribution to the discussion. In the fifth week they were required to make a final posting commenting on how the issue should be resolved. Required pre-reading was the university's Code of Practice – Assessment, and two brief articles on criterion and norm referencing.

The Scenario

The opening scenario was posted to both bulletin boards as a *Daily View News Article.*

> A lecturer at Idontgoto University, Dr E. Galitarian, has given all of her students 100%. All 38 students in the subject PHR356 Professional Skills in Phrenology have received grades of 100% because Dr Galitarian claims each of them gained mastery on all of the required skills according to criterion referenced tests. An expert in Higher Education, Dr Norm Alc urve, was contacted for comment and said: "Normally universities use norm referenced assessment, which means students can be sorted into different grades somewhere between 0% and 100%. With norm referenced assessment you would expect quite a spread of scores. On the other hand, where criterion referenced assessment is used appropriately, it is quite proper that all students should gain 100% if they have all reached the set criteria. It depends on what kind of assessment you consider appropriate."

During the role play the moderator made various postings in the form of a news item or editorial comment. These items were not pre-planned but were in response to the ongoing discussion. For example when one role play group's postings proposed that criterion referenced assessment should not have been used at Idontgoto University because it was compromising standards, the following Newsflash appeared.

> A leading educator at Ialwaysgoto University medical school (where criterion-based assessment has been used successfully since 1992) has challenged the academic staff of Idontogoto University to clearly explain to the international academic community the reasons why criterion-based assessment is unacceptable. Professor Will Igetafarego claimed, "We have been turning out medicos since 1992 using this system and our graduates haven't lost a patient yet. I'm sure the community doesn't want doctors who have been graduated by universities that give out degrees to students who only got half of everything right."

When an apparent lack of understanding of norm and criterion referencing emerged, a news item appeared which purported to be an interview with one of the experts in the field explaining the difference between the two. The expert was John Biggs, whose book, *Teaching for Quality Learning in Universities* (1999) is the set text for the course. Interview quotes were taken from the text.

Participation

Participants were members of academic staff from a variety of disciplines within the university. Seven of the participants were from countries in the Pacific Rim, Asia and the Indian Subcontinent. Three of these participants had been very quiet in the face-to-face workshops during the course, requiring extra effort on the part of the moderator to involve them in discussions. It was hoped that these quiet participants might find the online environment more conducive to interaction than the face-to-face workshops. The opposite was the case. Those who were quiet in face-to-face sessions were also 'quiet' in the role play. They made fewer postings than most other participants, their postings were generally shorter, sometimes repeating statements from other postings and/or making uncritical and sometimes confused statements, for example:

"*... I believe a normal curve on student results is reasonable and should be the criterion reference assessments of standard model...*"

"*... It is my opinion that a better performed student in a number of subjects is likely to perform better in the rest of the subject...*"

A few participants experienced initial difficulties in logging on and/or understanding instructions (despite having been given an introductory hands-on WebCT program). Others needed a lot of email prompting. In both groups participants did not attempt to enter the bulletin board until the second week of the four-week activity, even though participation was an assessment task within the course. The moderator found it necessary to send several emails to individuals and groups reminding them about the role play and encouraging them to take part. When some still did not respond, reminders about course requirements and requests to cooperate in the activity were sent. Despite repeated encouragement and reminders, four participants made only one or two postings.

It was nine days before the first posting was made to role play #1, with the Vice Chancellor adopting a parodic, dictatorial role and signing the postings Dr D. M. Igod:
"...I can assure readers that all (former) students of the late Dr Galitarian have been re-tested and the expected 5% have failed..."
Several characters responded to the Vice Chancellor offering advice ranging through tolerance, freedom of speech and one even suggesting medication. Role play #2 began after twelve days with little apparent commitment to character by most participants. Role play group #2 did not achieve the participation, interactivity or critical content of #1 over the next three weeks. All but one participant in role play group #1 posted at least three times but only two participants in role play group #2 posted the minimum required and, as indicated above, two dropped out of the course.

In role play group #1 most contributions displayed some evidence of thoughtfulness about the topic but not extensive knowledge. Issues such as equal opportunity, academic freedom and power were also mentioned if not explored fully, for example:
" ... the norm referenced system is a means by which academics control the teaching of subjects for their own needs and thus their promotion chances..."
"...The matter of concern to your readers needs to be viewed within the broader scope of other subjects within the degrees that have PHR356 as just one component..."

In role play group #2 contributions were shorter, tending to repeat the *Daily View* postings, and were sometimes superficial, for example:
"...I am very glad to hear that the Ialwaysgoto University medical school is successful with using criterion-based assessment. It would be interesting to know how many universities in this country are using criterion referenced assessment successfully..."

In role play group #2 only two participants began to explore the topic but never really addressed the key issue, for example:
"...There might be several reasons to cause the result: (1) Examination questions or other assessment methods such as assignments or essays are too easy. (2) The learning objectives of the subject are relatively low. (3) Assessment methods might not be reasonable ..."

Few participants in role play group #2 appeared to be engaged in their roles and there was little informed debate about the issue. The final postings in which participants were to indicate what the next step should be were not insightful. Either participants did not do the required reading or they did not understand the material. Some did not seem to have much idea about the role they were meant to play – for example the following response could be considered uncharacteristic of an authentic Student Representative Council Chairperson.
"...It looks very fair for all students since everyone got the same marks. In fact, it is not fair for bright students..."
The final postings, in which participants were to indicate what the next step should be, were also variable in quality. Most in role play group #1 summarised aspects of the issue and offered some kind of solution that might be considered to be at least partially educationally sound. Again those role play group #2 participants who had not fully participated, demonstrated little or no evidence of having done the reading or understood the issue, for example:
"... criterion based assessment involves high level of subjectivity which might cause discomfort for many people..."
"...I believe a normal curve on students results is reasonable and should be the criterion reference assessments of standards model..."

Engagement was also differential. Some participants like 'Dr I. M. God' had fun with the role, some adopted their role minimally, while others just made postings signed with the appropriate name. One participant who engaged with the student role wrote about their imagined experience with criterion referencing and added a sarcastic twist:
"We all felt proud of our achievements and it gave us additional confidence in our professional skills until you [The Daily View editor] came along and ruined it for us. Thank you for that."

Debriefing and Evaluation

Initially it had been planned to give all participants access to all role play postings and then administer the questionnaire online. Because participation was not as enthusiastic as expected, it became a concern that participants might not go online to read the other group's work or complete the questionnaire. It was therefore decided to conduct a debriefing and paper-based evaluation face-to-face within the course. The debriefing was intended to reinforce learning, clear up the many misconceptions about the topic, discuss the process and evaluate the activity.

In the face-to-face debriefing, several of the participants became involved in a discussion about the relative merits and uses of criterion referenced and norm referenced assessment and the role play process. It was noticeable that the previously mentioned 'quiet' participants again did not volunteer information unless asked and then made fairly non-committal statements.

Findings

From the questionnaire which was completed by eleven of the fourteen participants, eight participants agreed the role play was an effective process for exploring the issue and nine agreed that anonymity was a key factor in their involvement and comfort. All indicated they had contributed seriously to the discussion but only five indicated feeling engaged with their role.

Written comments about positive aspects varied and included: playing a role; seeing how differently others see things; seeing how role interpretation is based on culture; being in another person's shoes; discussion; interaction; a chance to learn; debate; having fun; exploring issues; anonymity; and feedback, for example:
"It was interesting to have people comment on things that you do and say, particularly things you don't think are being transmitted!"
"Ability to integrate learning, debate and fun."

Written comments about negative aspects varied and included: other participants who did not contribute seriously; not taking on roles; anxiety; time consuming; having to speak out; understanding some of the roles; and initial access problems, for example:
"Those who didn't do the 'fun' stuff as well as the serious stuff."
"Caused me a good deal of anxiety to participate."

Discussion

The findings above raise several key issues in relation to online role play.
1. What is role play and why use it?
2. How different are face-to-face and online role play?
3. What causes differences in participant involvement in online role play?
4. Is role play a Western game culture and does that affect role engagement?
5. How important is debriefing and how well does it work online?

What is Role Play and Why Use it?

Crookwell, Oxford and Saunders (1987, p. 155) describe face-to-face role play as "a social or human activity in which participants "take on" or "act out" specified "roles" often within a predefined social framework or situational blueprint." The use of face-to-face role play in education has been described as an "... attempt to understand human action and experience" (Yardley-Matwiejczuk, 1997, p. 5). Van Ments (1999, p. 9) writes "The idea of role-playing is ... to give [participants] the opportunity to practise interacting with others in certain roles." The adoption of the role may be short and episodic, as simple as a teacher asking a student to show a class how they think another person might react to a situation, or as complex as a group of people acting out a conflict situation.

Role plays are considered by Gredler (1994) as a subset of simulations, having less complexity and length. Simulation is a complex, evolving exercise while role play is a single incident (Gredler, 1994). In simulation participants do not invent background information or improvise facts or events. Instead they execute a particular set of responsibilities (eg. manager, client) using given information. In contrast participants in a role play do not receive detailed background information. They receive a brief outline of the situation and sketchy information about the role (eg, you are an angry student who has failed an assignment) and they are free to improvise reactions and events. Ladousse (1987) also indicates simulations can draw out more subtle nuances than role play. Yardley-Matwiejczuk views role play as much closer to simulation, stating that role play describes "a range of activities characterised by involving participants in 'as-if' or 'simulated' actions and circumstances" (1997, p. 1).

So role play is *simulation* in that it simulates the participant's idea of some other "real" world; but *a simulation* goes further by setting a system in place for the role players to operate within. In all events, role play may be described as a medium that provides an imaginary context in which issues and behaviours may be explored by participants who take on a specific role or character.

Why should educators use role play? Role play is a form of experiential learning that is widely used in training because it can lead to powerful behavioural and attitudinal outcomes (McGill and Beaty, 1995; Turner, 1992; Eitington, 1989; Craig, 1987; Shaw et al., 1980). Role play has long been used in educational and therapeutic settings to practise skills; explore sensitive issues; expose behaviours; and sensitise participants to other ideas, attitudes and values. Role play offers a unique potential for the generation of action (Yardley-Matwiejczuk, 1997) largely because it is such a flexible method with respect to range and depth of focus.

A well organised and operated role play can provide the experiences, and importantly the opportunity to reflect on those experiences, that help change attitudes or behaviour. It can be highly motivating and enables students to put themselves in situations they have never experienced before, where they can empathise with, and come to understand, other people's motivations. It can also give life and immediacy to academic descriptive material (Van Ments, 1999, p. 10-15). There is evidence that participants remember the learning from face-to-face role play long after they have forgotten much of the learning they learned in other ways (Van Ments, 1999; Gredler, 1994). Rapid feedback for both student and tutor is provided. Importantly, as noted by Ladousse (1987) role play can also offer the opportunity for people to have fun while learning.

Can we expect the same advantages from online role play? Are online role plays being developed simply because the technology makes them possible? Is role play an attempt to improve poor participation in an online environment? Harasim, Starr, Teles, & Turoff (1995) indicate that online forums moderated by novice web site designers are not well used and suggest role play as one of several approaches to improve participation. Wills et al., (2000) use role play in an attempt to enhance the use of an online database that was being searched in a shallow, perfunctory fashion by the online database users.

While improving participation in existing activities might be a reason some moderators decide to use online role play methodology, more positive reasons for using online role play include the advantages of an asynchronous, text-based medium within what is assumed to be a safe and low-risk learning environment. An example of this approach is a role simulation that enabled students to understand the complex pressures that impact on people in the financial sector (Freeman and Capper, 1999).

How Different are Face-to-Face and Online Role Play?

Face-to-face role play involves acting as another person through voice, gestures and actions. It involves immediate interpretation of, and reaction to, signals from others. Online role play is text-based, the writing can be done after reflection and may be edited. Written contributions may be more considered and more permanent. Obviously participants are able to utilise resources (people and materials) to prepare their contributions and can even discuss the role play with each other outside the forum.

This study raises the question – within the asynchronous text-based environment, do participants really take on a role in an immediately responsive way, or do they rather compose messages in a way they think would be expected of that role? If the latter, this would constitute one of the key differences between face-to-face and online role play. Participants could take part in online role play without actually engaging with their role and without observing others engaging in theirs. The writer suggests that if this were the case, empathy – the feeling of what it is like to be in someone else's shoes – would be unlikely to develop. Further, the absence of empathy might increase the possibility of participants responding stereotypically, which is one of the hazards of face-to-face role play (Yardley-Matwiejczuk, 1997; Craig, 1987) and stereotyping reinforces and sometimes creates prejudices. The writer noted that where role engagement occurred within this case study it seemed minimal, and the roles tended to be stereotypes rather than realised.

What causes Differences in Participant Involvement with Online Role Play?

This role play took place over four weeks and only one posting per week was required. It is possible that a shorter but more intensive experience might have encouraged more involvement. Berge (1995, p. 25) recommends that computer conference moderators constantly keep in mind individual differences within the conference. There may be a wide range of intellectual, personality, emotional and technical levels. Some face-to-face role play facilitators actually assess the role play skills of individuals and select those to play significant roles in order to ensure the role play is effective (Yardley-Matwiejczuk, 1997). Differential involvement is therefore to be expected, although it is a significant issue where learning is interactive and dialogic. The advantages of anonymity and asynchronicity are discussed below.

Online role play, unlike its face-to-face counterpart, can be anonymous. Most participants indicated their approval for the anonymity of the role play but is there any educational reason for anonymity? Does anonymity actually help people participate more – or even learn better? A problem in face-to-face role play is the level of emotional risk involved where a student is asked to perform a role in public and the performance is observed and criticised (Van Ments, 1999, p. 49). This risk is removed where roles are anonymous to other students and contact is limited to the written word.

Some writers have suggested that anonymity in online discussion may increase equity (Collins and Berge, 1995) and participation rates (Hartman, Neuwirth, Kiesler, Cochran, Palmquist, Zubrow, 1995; Connolly, Jessup and Valacich, 1990).

Freeman and Capper (1999) found anonymity helped non-English speaking background students to contribute to role play because students felt more free to "criticise" others, which they would not do in an environment where they could be identified.

McComb (1994) indicates asynchronicity is a particular benefit for those who are shy, uncertain or linguistically less able. Chester and Gwynne (1998) however note the difficulties for an Asian student communicating in a text-based medium. In this study, the three participants identified as low-verbal participants whose first language was not English posted responses that were either short, superficial or apparently confused. However the non-English speaking background participants who had demonstrated strong verbal skills in face-to-face activity were actively engaged in the role play using written language for critical analysis and/or humour. This suggests that for involvement, language proficiency and confidence may be more significant than cultural background.

Chester and Gwynne (1998) speculate on the possibility that antisocial behaviour may be a consequence of online anonymity in computer conferencing, at least with short-term interactions. This may relate to Gunawardena and Zittle's (1997) concept of "social presence" – the degree to which other people in an interaction are perceived as "real". Gunawardena and Zittle indicate social presence is a factor of both the medium and of the communicators and it is a strong predictor of "learner satisfaction" in computer conferences. Social presence is high in face-to-face and relatively low in text-based media. Anonymity would seem to reduce social presence even further.

A further argument against anonymity is the proposition that the keys to success in distance learning are honesty, empowerment, responsiveness, relevance, respect and openness (Palloff and Pratt, 1999). Within the higher education literature, Laurillard (1993) and Ramsden (1992) indicate that learning is a dialogic, constructive activity. This means learners need to be able to explain and critique their own and other's beliefs in order to test them, and this requires honest and open interaction. Few, if any, offline interactive learning activities in higher education are anonymous because educators expect their students to communicate and defend their ideas and hopefully to develop the generic skills of discussion, presentation and self-confidence. Indeed Pence (1996) actually suggests anonymity may be a hazard to the development of academic community.

Is Role Play a Western Game Culture and How does that Affect Engagement?

Role play, like any other teaching method, has epistemological implications. "Game culture will always reflect some complex interaction between the prior beliefs brought to the game by the participants and the scenario postulated by the simulator" (Benson, McMahon and Sinnreich, 1972). A role play scenario is in reality a statement that encompasses the designer's beliefs and cultural background. In this study, the scenario encompassed the designer's ideas about the roles of the Press and stakeholders; university culture; the connection between self and role; and the designer's penchant for parody.

Is online role play a comfortable medium for students from non-English speaking cultures? Differences in cultural styles have been noted by, for example, Ballard and Clanchy (1991) and Chalmers and Volet (1997) who indicate that many overseas students need time and support to adapt to an educational context where self-direction, active participation and critical thinking are emphasised. Those participants who were less actively engaged in their roles were identified as from non-English speaking backgrounds with low-verbal involvement in face-to-face workshops. As noted above, the non-English speaking background participants who had demonstrated strong verbal skills in face-to-face activity were actively engaged in the role play, adopting their roles at least minimally and with some humour. It may be that language proficiency rather than cultural background is the more significant factor in both involvement and role engagement.

How Important is Debriefing and How Well does it Work Online?

Van Ments (1999) emphasises that debriefing, where meaning is clarified and learning is underlined, is the most important aspect of face-to-face role play. Face-to-face role playing requires total immersion in the problem while the analysis of the role play requires a deliberate stepping back. Participants need the opportunity to dissociate from their roles, clear up factual errors and enter into reflective discussion.

What level of debriefing is necessary following online role play? Berge (1995) notes that the computer conference moderator's role includes the provision of summary remarks at the conclusion of the debate. Such a summary after the role play would help correct any misconceptions and inaccuracies. In this study the moderator noted that some misconceptions and inaccuracies were in evidence (and perhaps reinforced through the agreement of others). There was a need to correct these. A face-to-face meeting was held because there was a concern that participants might not 'attend' an online debriefing.

During the debriefing, the focus of discussion was on the learning outcomes related to the topic rather than helping participants step out of role. This was because participants indicated they had no feelings of engagement with their roles at this time, which was several days after the role play had ended. It is suggested that because it is possible for online role play participants to engage in stereotypical roles, the debriefing should deconstruct any stereotypes and encourage empathic discussion of the various roles. The level of role debriefing required after online role play, and the effectiveness of role debriefing online, require further exploration.

Conclusion

This paper has described a case study into an asynchronous, anonymous, online role play with participants in a teaching course for academic staff. Most participants reported the process to be effective for learning about the topic and appreciated the anonymity of the method. Some valued the opportunity to see the issues from different perspectives. Only some participants achieved engagement with their roles which tended to be stereotypical, and levels of involvement in the activity varied.

The study suggests that online role play can fulfil a valuable educational function but may not have the key advantage of face-to-face role play – the possibility of significant empathy through role engagement. It may have an advantage over face-to-face role play in that the online environment enables role players to be actively involved in an emotionally safer and lower-risk learning activity.

The study raises some issues for further exploration as follows.

- What level of role engagement is expected, possible and useful and how can empathy rather than stereotyping be encouraged?
- Is role play a Western game culture and if so what provision should be made for students from other cultures?
- How do asynchronicity, anonymity and the text-based interaction affect involvement?
- What method of debriefing is most appropriate?

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DESIGNING REAL-LIFE CASES TO SUPPORT AUTHENTIC DESIGN ACTIVITIES

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Abstract

Teachers in a range of disciplines are interested in engaging their students in authentic activities that reflect the experiences of real-world practitioners. Adopting this approach requires the design and implementation of learning environments that incorporate and support such activities. This paper describes two real-life cases developed as support materials for learners undertaking a major multimedia design project. Their implementation in a graduate education subject forms the basis of a wider study investigating learners' interpretations and use of case materials.

Keywords
case-based learning, authentic activities, multimedia design

Introduction

Many teachers recognise the value in involving their students in tasks that reflect the way knowledge and skills are used in practice. The challenge they face is to incorporate these authentic activities and the realistic contexts needed to supported them into the learning experiences they design for their students. One popular method for illustrating the complexities of real life is with cases which present detailed accounts of situations through the actions of key characters, the issues that arise and the outcomes that eventuate. As part of a study into how learners interpret these rich sources of information, two cases documenting real-life design projects were created to prepare students embarking on the development of their own multimedia package. This paper describes the theoretical framework, design decisions and the implementation of the cases in a graduate subject which was the focus of the investigation.

Theoretical Framework

Authentic Activities

Many theorists argue the importance of providing students with authentic experiences - experiences that reflect real-world ways of knowing and doing. It is thought that such experiences allow learners to transfer knowledge from formal education to practice, and so provide opportunities for meaningful learning.

These ideas are based on recent re-conceptions of learning which suggest that (Grabinger, 1996, p. 667):

- "People transfer learning with difficulty, needing both context and content learning."
- "Skills and knowledge are best acquired within realistic contexts."
- "Assessment must take more realistic and holistic forms."

In designing learning environments to support these authentic activities there must be an alignment between the context in which learning is presented in the formal setting and the real-life setting in which that knowledge will be called upon. But what is meant by authenticity and how can these kinds of experiences be designed and supported?

Some researchers conceive of a generic kind of authenticity. Such activities achieve authenticity because they reflect the nature of real problems as being complex, ill-structured, collaborative, containing multiple perspectives and offering multiple paths and solutions (Young, 1993; Squires, 1999). Jonassen (1999) suggests that an authentic activity may simply be one that is personally meaningful to the learner - that is engaging and relevant in a way that assists them in their own meaning-making.

Other researchers argue that emphasis should be placed on engaging students in cognitive processes that reflect the real-world counterpart (Anderson, Reder, & Simon, 1996). This would involve learners in the same types of cognitive challenges as are present in the work environment, but not necessarily in exactly the same tasks an expert practitioner would perform (Savery & Duffy, 1996).

Honebein, Duffy and Fishman (1993) argue that an activity is not inherently authentic, but authentic in relation to some other activity. The level and nature of authenticity presented to learners will depend upon many factors. Some situations may require a high level of sensory fidelity in their representation so that practical skills may be developed. Other learning situations may focus more upon developing or applying conceptual knowledge or skills, such as critical thinking or problem solving. In others social interaction and negotiation may be crucial.

Case-based Learning

There are a variety of reasons espoused for adopting a case-based approach to learning. A prominent argument is that case-based learning involves complex, authentic situations in which the learner (usually a novice) must learn to think like a practitioner (an expert). This reflects a view that learning is a process of moving towards greater expertise.

Cases offer a means to contextualise learning in a way that connects content and action. Schank and Cleary (1995) characterise case-based learning as a natural extension of our ability to learn from previous experience. Experts are people with a store of previous cases upon which they draw when confronted by a new situation. Jonassen (1999) argues that the inclusion of cases in a constructivist learning environment provides learners with access to experiences that they have not previously encountered. Furthermore a case-based approach which combines engagement with meaningful real-world tasks and expert coaching can provide deeper insights into processes and practices (Jonassen, 1993).

Riesback (1996) describes case-based reasoning as requiring learners to compare a new situation to previous experiences by looking for matching characteristics and then adapting old solutions to create a new one. In order to successfully retrieve previous cases learners must label (or index) them appropriately at the time of learning - the goal of learning being to transfer knowledge to a new situation.

Using cognitive flexibility theory as their basis, Spiro and Jehng (1990) argue that multiple representations, such as those offered by case-based instruction, best support learning in complex, ill-structured knowledge domains. Their approach attempts to retain the complexities and contradictions inherent in realistic situations.

The use of cases for learning is not new. Case-based instruction has a firmly established tradition in professional disciplines such as business and law, most notably at Harvard University (Sykes & Bird, 1992). Recently cases have found application in other disciplines, such as teacher education, educational psychology and instructional design (Ertmer & Russell, 1995; Kinzie, Hrabe, & Larsen, 1998).

Although case-based learning has developed a variety of interpretations and applications, the approach is most broadly defined as requiring "students to actively participate in real or hypothetical problem situations, reflecting the kind of experiences naturally encountered in the discipline under study" (Ertmer & Russell, 1995, p.24). Different conceptions of teaching and learning will determine the nature of the cases developed and the ways in which learners interact with the materials (Merseth, 1991). Most authors discuss two aspects of the case method: a) the case narrative or description and; b) the implementation of the case (or cases) in the learning environment.

Cases may act as examples or illustrations, present new knowledge or describe a problem situation. Cases may be paradigmatic, exemplary or idiosyncratic. The essence of a case is the description of the context, including the physical, social and organisational aspects (Jonassen, 1999). Materials may consist of one detailed case requiring sustained engagement, possibly from multiple perspectives, or feature short vignettes on a variety of topics. As noted by Sykes and Bird (1992), little is known of the effectiveness of these alternatives and their suitability is likely to depend upon such factors as the availability of background material and the desired learning outcomes.

The representation of the case-based learning materials must also be considered. While text is a popular traditional medium, the Cognition and Technology Group at Vanderbilt (1992) prefer to use high-quality video and computer-based formats which offer increased scope for sensory fidelity (see also McClellan, 1991). Supporting resources may include written documentation (including letters, reports, memos, articles), graphics, audio, video or animation.

The most common approach to implementation of cases incorporates study questions as a focus for individual reflection, small group deliberations and whole class discussion (Ertmer and Russell, 1995). Variations on this approach include: participation in the case as a simulation or field experience (Sykes and Bird, 1992); inclusion of cases as support for decision-making (Edelson, 1993) and; student preparation of their own cases (Benham, 1996).

Support for learners in the form of scaffolding and modelling may also be a feature of a case-based approach. Spiro and Jehng (1990) advocate the inclusion of commentaries which provide learners with expert guidance by explaining how cases relate to themes and how themes are related to each other. Jonassen (1996) describes a case-based learning environment that aims to bridge the gap between advanced biomedical knowledge and its application to real-world clinical diagnosis with scaffolding in the form of calculation tools provided at major decision points prompting learners to investigate relationships between variables. Miller and Kantrov (1998) emphasise the need for case analysis to take learners beyond the immediate scope of the case context to address larger issues and extract generalisations.

It is important to make a distinction between approaches which are predominantly case- or problem-based. Problem-based learning shares many of the same attributes as the case approach in that it seeks to engage learners in authentic activities within realistic situations. Ogden (1984) makes the useful distinction that case-based learning is the study of past solutions whereas problem-based learning involves developing a 'new' solution. Cases are of value in providing multiple perspectives and examples, particularly relevant for the kind of case-to-case reasoning required in a legal system reliant on precedents. Problem-based approaches often use a case as the starting point only. For example, medical students working in small groups are presented with a problem situation constructed from actual patient records and using the process of research and clinical reasoning arrive at a diagnosis (Williams, 1992).

The literature on case-based learning is dominated by theoretical arguments for its instructional effectiveness and descriptions of the design and application of a case-based approach. There is however little research reporting on the nature of the case-based learning experience - a shortcoming noted by many authors including McKeachie (1994) and Ertmer & Russell (1996). Specific studies have explored some aspects of case-based learning, such as self-regulation and problem-solving behaviour, however these do not yet form a connected or comprehensive body of knowledge. In particular little is known of how learners make sense of the rich contextual information presented in a case and use that in other situations.

The Design of a Case-based Learning Environment

The Setting

The study was conducted with two groups enrolled in *Interactive Multimedia Design*, an advanced level subject in the Master of Education in IT program at the University of Wollongong. Students in the subject form small project teams and work with a real client to develop an interactive multimedia package which will address a specific educational need. The nature of the task requires learners to draw on conceptual knowledge and production skills developed in previous subjects, to work within a team of people with diverse interests and backgrounds, and to manage the relationship with a client who might have different expectations of the process and outcomes. These are also aspects of a real-world multimedia design project, and through this activity learners encounter situations similar to those a professional designer would experience.

Like any other learning activity which aims to be authentic, there are limitations that need to be recognised. Although this is a team project, the other members of the development team are also students. This means that the relationships and hierarchy do not reflect those that would be found in a real world design team, with implications for the authority of the project manager in the student group. Also most of the team members will have rudimentary production skills rather than be experienced graphic designers, media production experts or programmers. This may impact on how team works together and manages their own and the client's expectations of the final product.

Design of the Subject

There is arguably no such thing as a typical instructional design project. Each is influenced by a variety of factors including the educational philosophy of the teacher/designer, the characteristics of the students and the institutional setting and, the availability of human and financial resources - all of which must be assessed and reassessed throughout a project.

Goel and Pirolli (1988) argue that design problems by their very nature are not amenable to rule-based solutions. The ill-structured nature of instructional design problems means that not only are there multiple paths towards a 'solution', but that there are multiple interpretations and solutions as well. Expert designers address these complex, multifaceted problems by drawing on their knowledge of theory and research and their previous professional experience.

Jonassen's (1999) model for a constructivist learning environment (CLE) provides a framework for supporting learners as they work on their own design problems. Cases present solutions to past problems that may compensate for learners' lack of experience and may help learners develop an understanding of concepts and strategies useful in similar situations. This model has been used as a framework for redesigning the subject, as described below.

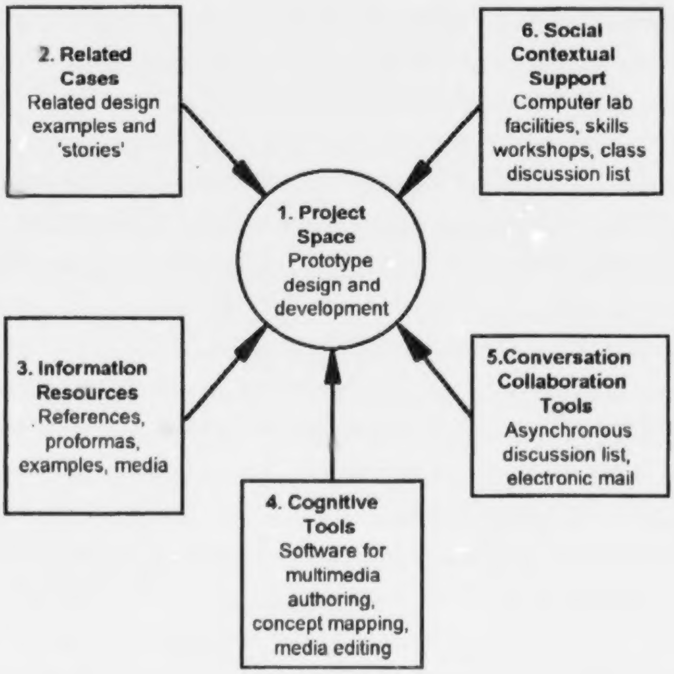
2. Related Cases
Related design examples and 'stories'
6. Social Contextual Support
Computer lab facilities, skills workshops, class discussion list
1. Project Space
Prototype design and development
3. Information Resources
References, proformas, examples, media
5.Conversation Collaboration Tools
Asynchronous discussion list, electronic mail
4. Cognitive Tools
Software for multimedia authoring, concept mapping, media editing

Figure 1: Jonassen's model for a constructivist learning environment

1. Project space

The project space is the focus of the learning environment and in this subject comprises the design 'problem' for which learners develop a multimedia solution. Students work in small project teams and liase with a real client. A number of clients are available for learners to chose from or they may find their own. The design problems tend to be ill-structured and complex and engage learners in the kind of thinking required by practitioners in the design and development of a project.

2. Related cases

Cases provide the main instructional support and analysis activities focus on developing the learner's understanding of instructional design through individual reflection and group discussion. The activities incorporate two facets of case-based learning suggested in the literature - 1) learning from experts and 2) developing ideas through personal reflection and social interaction. The two cases developed for this subject provides insights into the experiences of the designers that enhance learners' understanding of the development process.

3. Information resources

Information resources include references to relevant sources of information including readings and Websites, proforma documents that can be used to guide the development of design statements, examples and descriptions of other projects, and useful media resources.

4. Cognitive tools

Students use multimedia authoring software to explore and test their design ideas on-screen, leading to a prototype version of their multimedia package. Other software tools are made available to assist learners with problem representation and concept mapping, information gathering and organisation, storyboarding and media design.

5. Conversation and collaboration tools

Asynchronous communication tools, such as electronic mail and discussion lists, are used to support interpersonal, small group and whole class interaction. An array of other tools are available to meet the individual communication needs of the project teams.

6. Social/Contextual support

Social and contextual support is provided through a class discussion forum for general communication, access to the computer laboratory facilities and other meeting spaces, and the scheduling of face-to-face meetings and optional skills development workshops. The role of the instructor as facilitator and mentor is an essential component of this environment.

Design of the Cases

Ertmer and Russell (1995) suggest that instructional design students need to develop skills in problem-solving, critical thinking and reasoned judgement needed to work with complex, multi-faceted design problems. The table below outlines the design principles that underpin the development of the cases in relation to the desired outcomes for this subject and the team design activities.

Instructional design students need to develop the knowledge and skills to:	*Case materials and activities aim to develop these skills by engaging learners with realistic, detailed design cases which:*	*The team design activities aim to develop these skills by engaging learners in a project which requires them to:*
make sense of a complex design problem by identifying and analysing the critical issues in a situation	contain multiple issues and perspectives	describe and assess the features of a particular learning problem
consider multiple possibilities for design solutions by applying knowledge of instructional strategies	illustrate how designers generate their initial ideas from an understanding of instructional strategies	consider how different strategies might be applied to a particular learning situation
select the most appropriate solution by considering possible designs in light of situational factors	illustrate how designers determine which methods are most suitable in a particular situation given a range of contextual factors	determine which design solution would be most appropriate in a particular situation
communicate design decisions to others and negotiate as necessary	include details of communication between designers and others	work with a real client to whom they must explain and justify their design decisions
document and/or prototype a design solution	include relevant documents and files as part of the case materials	prepare a description of their design within a design statement template
evaluate a design solution in terms of the initial problem	include the designer's reflections on the overall process and solution	evaluate their design solution by reflecting on their project experiences and their original intentions

Table 1: Desired outcomes against case analysis and project tasks

The instructional design cases prepared for this study illustrate the nature of design problems as ill-structured and ill-defined. The two cases are real-life examples, tracing the development of *Exploring the Nardoo* and *StageStruck* by the Interactive Multimedia Learning Laboratory in the Faculty of Education at the University of Wollongong. The cases present the approach of the project designers to interpreting the needs of the client and target learners, developing appropriate instructional solutions, representing their design ideas and implementing these in the product. The cases are not presented as exemplars, but instead aim to convey the multiple issues which arose and to illustrate the ambiguities and contingencies that are part of the design and development process.

The case materials themselves depart from the traditional narrative form in which the case author summarises the events for the learner. As the intention is to provide a rich information source that learners can explore and make sense of themselves, materials are maintained in their 'rawest' form. In doing so it is possible to maintain a level of detail, complexity and ambiguity which would be more difficult to achieve in a concise format.

Constructed as a series of Web pages linked from the main subject site, the various components are linked from an introductory page which provides a brief overview of the project and a timeline of major events. These were developed from archival records of the projects including meeting notes, email communication and diary entries. They are the only 'pre-packaged' materials included and from here learners can follow links to a range of other resources.

These include accounts from the key project designers which, apart from minor editing to improve readability, are included as direct transcripts of interviews conducted with the researcher. This allows learners to read the conversation in its original context and in the designer's own words. Students can also examine original design documents, including versions of the project design statements, storyboards, concept maps and early prototypes. Also included are reviews of the final products and papers written about subsequent research projects. Copies of the CD-ROM products are also provided to learners so that they can examine them in conjunction with the case accounts.

Implementation

The aim of the cases was to provide learners who were beginning work on their own team projects with access to accounts of other projects which might have relevance to their own. To focus their study of the cases they were given a series of analysis questions for which they provided individual responses. These questions asked them to describe the design process and key events, relate the experiences of the case designers to concepts from the literature and/or their own experiences, examine a particular design feature and identify the major management issues.

At the next class meeting a discussion in their project teams focussed on how the design and management issues highlighted in the case might be relevant to their own projects. These issues were then shared in a whole class discussion. This series of activities was designed to allow the learner to first develop their own ideas about the cases and then to share them with the other members of their team and later with the whole class group. The intention was also to take them from specific discussion of the cases to the broader issues and lead into their own project experience (as suggested by Miller and Kantrov, 1998).

Towards the completion of their group projects learners were also required to respond individually to a series of reflective questions and then submit their own reflective case developed collaboratively by the project team. The aim of this task was to draw them out of the often all-consuming project development tasks and ask them to again examine the main design and management issues, now in terms of their own project experience.

Data collected throughout the session in the form of student work, discussion list transcripts and interviews with students and the instructor are currently being analysed. It is anticipated that investigation of individual responses and the patterns and themes which emerge will provide insights into the ways learners examine and interpret the cases and use their understanding of them to inform their own project work.

Conclusion

An examination of the literature advocating the use of authentic activities suggests that cases may be useful in helping learners develop an understanding of the complexities of real-life situations. Two real-life cases developed to support learners undertaking a major design project provide a rich source of information featuring personal accounts and original documents. It is intended that learners will be prompted by the case analysis questions to explore the multiple perspectives and issues within the cases to develop their own view of the development process, and in discussion with others in their team and class explore the wider issues. This process of analysis, experience and reflection could also be applied to other learning situations in which learners with varying backgrounds and skills could benefit from the opportunity to examine a related case before they embark on their experience.

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THE INTERNATIONAL CLASSROOM: USING REFLECTIVE PRACTICE TO IMPROVE TEACHING AND LEARNING

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Abstract

As learning technologies increasingly facilitate the internationalisation of subject offerings, it becomes correspondingly important to try and ensure that the needs of diverse student groups are met, and to provide for ongoing improvement of their learning experiences. A variety of evaluation procedures is valuable in this respect, but particularly those that illuminate these experiences. This kind of information provides a rich source of data for teachers to use as a basis for reflective practice to inform the continuing refinement of teaching and learning approaches, and curriculum development. The nature of reflective practice also allows for its inclusion in the students' learning processes, thus simultaneously providing a means for improving the quality of their learning and contributing to their future professional lives, whilst offering a further set of perspectives to inform subject development.

This paper describes the use of reflective practice as a practical means of converging a range of non-positivist approaches to inform the teaching of a core undergraduate accounting subject; offered in Australia to on-campus students, distance education students and Victorian Year 13 school students, as well as to overseas students in Singapore, Malaysia and Hong Kong. It also shows that demands by the accounting profession for universities to improve learning to cope with the ambiguity and uncertainty inherent within professional life can be met, in part, by reflective practice.

Keywords

accounting profession, collaboration, computer-mediated communication, convergence, dialogue, evaluation, interactivity, international, multiple narratives, reflective practice

Introduction

The University's overall goal is to develop and maintain a flexible and student-centred learning and teaching environment which embodies the three key terms – innovation, engagement and internationalisation – and which provides undergraduate and postgraduate education of the highest quality (Monash University, 1999, p.12).

This paper describes how innovation, engagement and internationalisation are being implemented in a core undergraduate accounting subject via an iterative process of evaluation and reflective practice directed at the ongoing improvement of student learning experiences. The students include Australian on-campus (internal) students, distance education students and Victorian Year 13 (enhancement) school students, as well as overseas students in Singapore, Malaysia and Hong Kong. They are enrolled in Monash University's Faculty of Business & Economics which has 10,000 students across eight campuses in Australia, Malaysia and South Africa, and strategic alliances for program delivery in Singapore, Hong Kong and Indonesia. WebCT has been adopted to facilitate the Faculty's learning programs but there is currently wide variation in staff experience and use of the medium, and in the effectiveness of that use.

Computer-mediated communication (CMC) was introduced to the introductory accounting subject in 1998, primarily to reduce the isolation of distance education students (increasingly overseas students, especially from Singapore and Hong Kong). These students were enrolled in a subject area where the higher order learning goals relating to self-reflection on open-ended issues would appear to be best achieved and enhanced by dialogue. The use of CMC occurred in the context of a curriculum process that resulted in an issues-based subject supported by case studies and linked to the profession's own conceptual framework. An important factor which informed the decision to trial this approach was the perceived need by the accounting profession for graduates to be more broadly educated and to develop skills in exercising judgement based on the analysis of conceptual issues (CPA & CA, 1999). The profession continues to develop such a framework as a means of providing a unified theoretical base for the accounting discipline. Focusing the subject on issues thus supports the profession and plays an important role in meeting the professional bodies' accreditation criteria for university courses (CPA & CA, 1999). These criteria involve five cognitive and behavioural skill areas that are valued by the profession and which the accounting bodies expect to see developed in accounting graduates. While all skill areas are enhanced by an issues-based approach, it can also be argued that this approach is essential for some of the skills required, in particular behavioural skills which are defined to include personal and interpersonal skills. In addition, an issues-based subject requires an ability to cope with ambiguity, uncertainty, uniqueness and value conflict, all of which are central to professional practice, as well as to improving the quality of student learning (Ramsden, 1992).

The teaching and learning material for the subject prior to the use of CMC was print based. The subject was designed to encourage students to reflect critically but constructively on accounting principles, pronouncements and practices with a view to developing reflective judgement within a discipline that superficially may be considered prescriptive. An educational designer was consulted to ensure that the design of the print material reflected best practice for distance education students. Instructional material, activities and key issues were examined and adjusted to focus on the conceptual basis of the subject. The inclusion of CMC to achieve the higher order learning goals was a consequence of dialogue and reflection between the educational designer and the teacher of the subject. The initial use of CMC involved the provision of model answers to tutorial activities in the print materials and encouragement to discuss issues which arose from these and from open-ended questions interspersed throughout the material. Its introduction was also based upon the principles of enrichment and enhancement, given that online access was not a prerequisite for undertaking the subject. By 1999 it was clear that CMC needed to be better integrated into the teaching of the subject and that feedback was required about its use by students, which appeared to focus primarily on obtaining information rather than engaging in the interactive opportunities provided. A pilot evaluation was then undertaken to gain (mainly qualitative) feedback from Australian distance education students to explore their level of use and their perceptions of this component, and to provide a resource for reflection and decision-making by staff involved in teaching the subject.

The results of the 1999 pilot evaluation demonstrated a high degree of enthusiasm for CMC but also showed that access to the platform then used was a major issue. This was a primary reason for introducing WebCT into the subject in Semester 1 2000, although it also offered the advantage of allowing provision of online subject resources to complement those in the print materials. While WebCT solved many of the difficulties highlighted by the pilot evaluation it brought with it other challenges for both teacher and students, related to how students could be more involved in the learning process and in the ongoing development of the subject, its content and assessment methods. This indicated the need for a continuing and more extensive evaluation process.

At the heart of the introduction of learning technologies into this subject is an ongoing cycle of curriculum development and a desire to incorporate sound learning processes. Collaborative learning via CMC offered the potential to develop both the analytical and behavioural skills required, as well as providing a loop for incorporating students' ideas back into the iterative development of the subject. Despite the strong support for such an approach within the profession, its practical implementation within a discipline area that is highly didactic was more problematic, while the diversity of the student group across numerous geographic locations added to the challenge.

The use of CMC, and then the wider range of resources offered by WebCT, thus began from an educational rather than a technological perspective, and was always considered primarily as a means of achieving specified learning goals. Although there has been some success with WebCT, currently its main use can be seen as reflecting a surface learning approach (Marton & Säljö, 1976) rather than the level of conceptual and behavioural learning that it is hoped can be achieved. The process so far, supported by the evaluation data, would suggest that incremental and reflective steps, based on evaluation, are the most appropriate way to work towards achieving higher level learning outcomes.

Theoretical Background

The views of teaching and learning which are informing the iterative development of this subject represent the convergence of a number of theoretical perspectives, all of which are consistent with the intellectual heritage of Dewey:

> It requires candor and sincerity to keep track of failures as well as successes and to estimate the relative degree of success obtained. It requires trained and acute observation to note the indications of progress in learning, and even more to detect their causes – a much more highly skilled kind of observation than is needed to note the results of mechanically applied tests. Yet the progress of a science of education depends upon the systematic accumulation of just this sort of material (Dewey, 1974, cited by Schön, 1987, p. 312).

The intellectual processes of reflection, analysis and interpretation undertaken by teachers to improve their teaching, in many ways reflect the learning processes expected of students, when these are seen as involving construction of meaning (Jonassen, 1999), influenced by factors such as experience, cognition and context (Grabinger, 1996). To understand the world of the learner, concepts from phenomenography (Entwistle, 1997) are also useful as a means of drawing on students' experiences, ideas and perceptions 'from the inside', while to parallel this, the process of critical reflection by the teacher is a means of interpreting and using this information for the ongoing improvement of student learning. Although perspectives from critical theory (Mezirow, 1981) and action research (Carr & Kemmis, 1986) provide useful insights into this reflective activity, the development of this subject has drawn particularly on the concept of reflective practice (Schön, 1987) because of the links that it makes between reflection and professions that require a high degree of formal rationality, and the suggestion that reflection is both required by such professionals and those engaged in educating these professionals.

Reflective practice involves seeing learning as an iterative process. The importance of reflecting on that process has been termed 'action science'. The process of learning is seen as a complex social activity that cannot be reduced to simplistic thinking. Reflection plays an integral role both in the action and learning from the action. The reflection proposed here involves an openness that requires teachers to challenge their own assumptions and continue to develop their skills. It involves articulating what is normally unsaid and facing up to the distinction that exists between espoused theories and theories in use. It is a reflection that requires the explicit documenting of the shifting understanding of the learning experience, not just as an individual experience but also as dialogue (Schön, 1987).

While the use of Schön's term 'reflection in action' has specific reference in this paper to the professional educator, these ideas were developed in the interest of professions such as engineering and medicine where a high level of formal rationality that eventually results in instrumental practice shapes technical expertise. Schön argues that the most important areas of professional practice lie beyond the instrumental boundaries based on technical expertise and go into the more indeterminate areas of practice that deal with uncertainty, uniqueness and value conflict. The outstanding professionals in all areas, including those with high levels of formal rationality, reflect wisdom, intuition and artistry beyond the instrumental. Schön argues that this is not a gift but involves a process that he terms 'knowing in action' which is often combined with 'reflection in action'. Although there is a tension between the two forms of action, it is the combined iterative process that enables professions to achieve the outcomes that the practice of their art demands (Schön, 1987).

While 'reflection in action' has recently been used in the educational literature dealing with engineers (Osborn, 2001), it is not a term that has been taken up in the accounting literature. This is surprising, as the accounting literature has drawn on the links between the formal rationality and instrumental practice of engineers and accountants in terms of their management functions and consequences (Armstrong, 1985, 1987; Hardy, 1998). It is suggested here that 'reflection in action' is relevant to academics involved in the education of professional accountants, both in terms of their role as professional educators and also in the links that must be established between the theoretical discipline orientation of the university sector and the practice orientation of the accounting profession.

This paper therefore provides an example of 'knowing in action' and 'reflection in action' relating both to the professional development of the educators of professional accountants and the ongoing need for reflection within the professional careers of accountants. As in the tradition of 'action science', the process does not refer to a completed project and is not isolated to one individual. Rather it is a part of the ongoing albeit unrecorded need to extend the phenomenological tradition to the education of professional accountants and to the use of learning technologies in this context. It is also an overt rejection of technical domination of the iterative process and a response to the ongoing need to 'stop and think' as the uncertainty of the human condition demands (Schön, 1987), particularly in the current rapidly changing educational environment. Schön's 'reflection in action' requires a duality at this level between the professional educator and the professional accountant. It is argued that a curriculum design based upon this duality must involve interactivity between the teacher and learner in an ongoing narrative that, although initially promoted by the teacher, has within its structure the possibility of collaboratively engaging students in higher order thinking. This is being achieved by challenging the assumptions of traditional accounting pedagogy with its focus on a single narrative of instrumental and technical skills to suggest that there are numerous narratives that can be explored. It provides the basis for the level of interactivity that is being sought in this subject, founded on the need for ongoing 'reflection in action' both within the provision of education for professional accountants and in the practice of professional accountants.

The notion of multiple narratives provides a means of conceptualising the need for professionals to cope with ambiguity, uncertainty and value conflict, something that cannot be achieved by a curriculum that only offers one narrative and does not encourage multiple stories. This challenges the assumptions of traditional accounting theory and practice, providing students with a set of critical tools to take into their professional careers, one such tool being 'reflection in action' which requires that the tension between multiple theories and practices be part of the ongoing life of the professional accountant. This subject achieves this by asking students to consider how the standards as developed by the profession can be challenged, given the conservative assumptions that have been built into accounting practice. It also has the potential to feed back into the normative aspects of the existing conceptual framework in the context of its practical usefulness. For example, this approach is highlighted within the introductory accounting subject when it is suggested that a multi-dimensional view and critique of the historical cost approach to the measurement of profit can provide a range of narratives on the concept of profit.

The current curriculum thus provides an opportunity for students to move away from the content and linear based curricula of traditional accounting subjects, where a single response is both anticipated and expected. Interactivity, as suggested by Sims (1999a), is more readily achieved by a curriculum design which allows divergent but cogently supported views to be examined side by side. Such an approach if successfully implemented demands the development of higher order thinking, engagement and reflection with both the issues, fellow students and the developer of the curriculum. As such it is expected that the learner will 'become an integral part of the narrative or story being promoted by the developer' (Sims, 1999a, p. 312). Such a curriculum design within accounting requires the developer/teacher and the student to engage with each other outside of the instrumental norm, reflecting both on the educational experience and also its contribution to the professional life of the accountant, a double but seamless loop between educational and professional life.

The use of computer mediated communication provides a means of converging the benefits of both interactivity and reflective practice for supporting learning and improving teaching. Recognition of the importance of the social component in knowledge construction (Vgotsky, 1978) laid the groundwork for recognising the value of computer mediated group interaction, informing the range of theoretical and practical guidelines which have followed (for example, Mason & Kaye, 1989; Berge & Collins, 1995; Salmon, 2000). In its capacity to facilitate multiple narratives it works against the possibility of narratives interfering with interactivity as a means of engagement (Sims, 1999b) since it is the interactivity involved in exploring the narratives through dialogue which creates the engagement. What CMC has been able to begin to achieve in introductory accounting is to commence a dialogue between many of the stakeholders in this subject that was traditionally only available to internal students. In that sense the development of the subject is showing evidence of a collective narrative between teacher and learners. This is evident in a range of incremental but diverse ways, such as contributions to improvements in subject design (including refinement of issues and subject content), the CMC interface, and the ongoing development of the WebCT bulletin board as a means of enhancing dialogue between the geographically and culturally diverse students that make up the learners within the subject.

To evaluate the experiences of those engaged in reflective practice in this context requires methods that will bring teachers closer to the student viewpoint, while also recognising that all viewpoints are mediated by individual experience. Although teachers may recognise the need for learning which demonstrates the qualities discussed earlier, it is important as they reflect on evidence of student learning, and on students' perceptions about it, to recognise that there is likely to be a wide range in students' learning orientations (Beaty, Gibbs, & Morgan, 1997), and that measures to enhance learning will need to assist students across this range. This becomes of crucial importance when the classroom extends across campus and national boundaries.

Any attempt to explore student perceptions in detail requires data that is primarily qualitative: the mass of rich and unstructured information generated by such a process needs to be categorised for analysis, interpretation and reflection to improve future practice. Pre-coded instruments are likely to be teacher-centred (unless they are derived from previous student-centred studies) but when student responses drive the categorisation of the data, this provides a structure both drawn from, and with the potential of adding to understanding about, student learning experiences.

Morgan (1990) refers to the hegemony of survey research, which acts against the use of qualitative attitudinal data to inform the improvement of learning. However, the ease of administration and analysis associated with pre-coded quantitative instruments makes them attractive, even though their roots are outside of the student experience. To balance the benefits of both practicality and insight, the approach used in the formal evaluations of these subjects could be best described as fitting within an 'eclectic-mixed methods-pragmatic paradigm', as 'the one approach most capable of handling the complexity that is the hallmark of contemporary society and technology' (Reeves, 1997, p.173), though it is the qualitative aspects of this approach which have provided the most useful information for reflective practice. It is important to note that the survey instruments described below provided only one source of input into the narratives and dialogue that were informing the teacher's 'reflection in action' in regard to the subject. Monitoring the use that was being made of CMC by users provided the stimulus for seeking further input from those users as part of the teaching process itself. This was done initially because it appeared that many of the higher order goals and the potential engagement of users with the issues of the subject were failing to be realised. The two surveys undertaken should not therefore be seen as the only source of 'reflection in action' but rather as part of the rich fabric of inputs that make up the ongoing narrative and incremental nature of subject development. This is a narrative that values interactivity while understanding that it should not be pursued relentlessly and without due regard to the learners who are being asked to engage in 'reflective practice' both for educational and professional reasons.

Evaluation

In the small pilot study undertaken in 1999 to evaluate the role of CMC in the subject, Australian distance education students within the following sub-groups were asked to respond to a series of questions which were developed to gain their feedback and to determine their experience. Responses were sought from:

- those who did not try to use the technology;
- those who tried to use it and failed;
- those who used it but not for discussion (for example, use was confined to obtaining solutions or viewing the contributions of others); and
- those who used it for discussion.

This feedback was complemented by a small number of telephone interviews and reflection on the results of these, along with other experiences and feedback from teaching the subject, led to a series of steps being undertaken in 2000 to improve both the access to and quality of the service. As indicated previously, these steps included the introduction of WebCT.

As expected, the results suggested that it is difficult to provide a fully integrated online learning environment when the learning experiences are limited to enrichment and enhancement. As one of the telephone interviewees stated, 'You only put the icing on the cake if you've actually got the time.' Use was further limited by the fact that some students only had computer access in libraries, computer laboratories or community centres and many found the particular CMC platform which was used difficult to negotiate in limited time. Nevertheless, it was clear that students who had access were motivated to use it when they could see a central benefit to their study and its assessment. An important issue was that the communication system seemed to be valued mainly as a one-way information distribution mechanism, which as some students stated, could have been more effectively handled by a web page.

There was some appreciation of the value of interactivity (especially by those who used the system in this way) but timidity, the lack of a perceived need for discussion, and the fact that no structured discussion activities were set, tended to diminish its use in this way, despite evidence of 'lurking' students gaining some benefits from the interactivity of others.

The more extensive evaluation in 2000 was undertaken using the same instrument as in 1999 after adaptation to reflect the use of WebCT. It involved Australian on-campus (internal) students, distance education students and Year 13 (enhancement) students in Victorian schools, as well as overseas students in Singapore and Malaysia. A related form was designed for the 14 mentors of the enhancement students, seven of whom responded. Hong Kong students were excluded due to logistical problems. The student response pattern is summarised in Table 1.

Student category	**Responses**	**Percentage of enrolled students**	**Percentage of 134 respondents**
Australian distance education students	9/43	20.9%	06.7%
Internal students	19/35	54.3%	14.2%
Enhancement students	15/28	53.6%	11.2%
Singapore students	21/45	46.7%	15.7%
Malaysian students	70/109	64.2%	52.2%
TOTAL	134	N/A	100%

Table 1: Student response pattern

Despite variations, the response rate of almost 50 percent or better for all groups except the Australian distance education students was considered to be a good basis on which to reflect on this phase of development and plan for what was to follow.

While access remained a problem for some students, it had primarily become an administrative issue affecting enhancement and Malaysian students, and particularly related to user names, passwords and subject codes. Only one respondent had no Internet access at all. Again the results suggested that despite the optional nature of an enrichment component, the greater the rewards to be obtained from its use, then the more it is likely that students will find it providing a valuable contribution to their learning. Over 90 percent of respondents made positive comments about the provision of enrichment and enhancement material online and over 80 percent of enrolled students had used the WebCT site, as indicated by the hits. The more accessible structure of the web-based component (compared to the previous CMC tool), appeared to contribute to this, despite a number of suggestions relating to the need for improved navigation, more regular updating, and advice of when updating had taken place.

The respondents clearly found that the use of WebCT added value to the subject, particularly in relation to access to information, with this information again including bulletin board messages (and also now chat transcripts) even when students were not interactive themselves. It was also notable that on-campus students regarded it as a valuable extension to their learning.

However the predominant use of WebCT for obtaining information, rather than interactivity, continues as a major issue in improving student learning and in meeting the educational goals of the subject. This was evident in references to tutorial solutions, model answers, subject information and the tips, comments and notices of subject advisers as the most useful features of WebCT, and in requests for worked solutions to past exams, more questions and answers, and more information and advice as the most frequent suggestions for additional features which would encourage use of WebCT. There was a particular focus on the need for solutions to past exam papers by Malaysian students.

Further development of the use of the bulletin board (in preference to chat) would appear to have the most potential based on the responses of these students. Over half of the respondents were positive about the potential for bulletin boards in promoting communication in their subjects, and nearly a third commented unreservedly on its value in this subject (about a quarter of these did not contribute to it themselves). Comments, which illustrate the sense of community provided by the bulletin board, included:

- It is good to see how other people are going and the particular problems they are having. You can compare & it gives you the chance to see that you are not the only one having problems (Internal student).
- It's good as it allows other students to know what's going on with the subject (Malaysian student).
- The bulletin board was the most beneficial part of the WebCT to me as it was the means of posting queries. I was also able to view the doubts of other students which proved useful (Singapore student).

There was less enthusiasm for the bulletin board amongst the Malaysian students, with nearly half of them unaware of its existence or how to use it ('Did not know how to use it actually what's the bulletin board?', ''Unheard of', 'I dunno what it is at all') or choosing not to use it ('Didn't use, had no interest'). There was also limited use by a number of the enhancement students with inefficiency, lack of time and slow connections amongst the reasons given, with one commenting 'I didn't like having others read my querys (sic)'.

However, there were many more reservations expressed about online chat, which included references to time zones (and lack of Internet access at home), the inconvenience of having to commit to a particular time ('I work most nights, so therefore not home', 'I have lessons on scheduled dates for online chat'), trying to participate but finding 'no one was there to chat', forgetting when sessions were available, along with lack of use because students disliked it, considered it unnecessary or inefficient, or were 'not interested'. Again, a substantial number of Malaysian students did not know about it or how to use it ('Did not realise chat was available').

Responses on a number of issues suggested the importance of local staff, mentors or tutors to cater for the diverse student groups. Greater involvement at this level would appear to have potential in both increasing the role of WebCT in the subject, and in enhancing the effectiveness of that role in terms of student learning. This was evident particularly in the responses of the Malaysian and enhancement students, and in the responses of the enhancement students' mentors, where staff were involved in teaching and supporting the subject but were not closely involved in the development and implementation of the WebCT component.

Overall, the responses from the second evaluation indicated that important progress had been made with the introduction of WebCT, and that it was a valuable addition to the subject, particularly in relation to the provision of information. However, there were also emerging indications of its benefits (particularly via the bulletin board) in providing a sense of community within the international classroom. Based on these results, some of the main recommendations for the next stage in its development were to:

- refine administrative arrangements to provide personalised, easy-to-access entry to the WebCT site;
- design an orientation program and refine navigation to make student access to the site as easy and user-friendly as possible;
- increase staff involvement so that it occurs on a regular basis, perhaps in conjunction with regular advice on updates;
- involve local staff/mentors/tutors in the design and implementation of the online component; and
- develop the use of the bulletin board in a structured way, perhaps using the desire for increased information, and the provision of rewards for involvement, as tools in the design of its use.

Reflection

While it is tempting to focus on the successful engagement of students with WebCT at the instrumental level, the reflective process draws the practitioner back to the educational goals of this issues-based subject and the inherent ambiguity and uncertainty in their resolution. The reflective practitioner is unable to be satisfied with only technical success when the underlying purpose in using the technology was pedagogical. The outcome of the evaluation process, ongoing reflection on the teaching process, and the ensuing dialogue with a wide range of stakeholders has seen ongoing adjustments made to both the substance and presentation of the subject. Reflective practice suggests that the responsibility for developing reflective practice as a component of students' learning is as much based upon the practices of the teacher as the students. The notion of interactivity achieved through the multiple narratives of learners and teachers provides a rich and complex area to explore through a reflective process directed at the ongoing curriculum development of professionally oriented subjects. While it was the interactive potential to enhance learning that motivated the initial use of CMC, interactivity is far more difficult to achieve than transmitting information electronically. The use of CMC has the advantage of providing a sense of immediacy to the reflective teacher in an international classroom that other approaches could not supply and provides ongoing challenges as to the appropriate direction of the subject. It would appear that interactivity in this environment must take place in incremental steps, particularly via the creative use of the bulletin board. A more structured approach to the introduction of CMC with each new cohort, perhaps using the model suggested by Salmon (2000) and involving the teaching staff closest to the students, as suggested above, may have an important role in facilitating this. In turn, this would require an approach to academic staff development which was capable of adjustment to suit the role of the local teacher of each sub-group.

The importance of this issue is illustrated by the fact that the evaluation results have indicated that the technology, even at an instrumental level, is being taken up at different rates in different geographical locations and under different delivery models. The Malaysian students and the enhancement students have clearer links to local teachers who have not been closely involved in the development and implementation of CMC, and this appears to be related to its limited use by these students. In contrast, students in Singapore, who were more responsive in this mode, are more directly linked with the provider in Australia. If the development of the online component is to continue, all people involved in its development and teaching must collaborate in order to nurture the collaboration of students. As an issues-based subject is outside of the accounting discipline norm, there is a danger that students will not be convinced of the value of persevering with such an approach, despite the fact that it has the professional bodies' support and clearly has potential to promote interactivity in a way that more traditional approaches could not. If the value of these educational goals is not widely held and supported an instrumental outcome could become a de facto bottom line in the use of CMC to support students.

The process thus far, supported by both evaluative research and reflective dialogue, suggests that although the technology is available to meet higher order educational goals, the motivation of staff and students to be involved is still a complex educational issue: the online learning environment increases the potential and the complexity of interactivity whilst teasing the reflective practitioner, at both the educational and professional accounting level, with its possibilities.

Conclusion

It is suggested that reflective practice as described in this paper makes a contribution towards achieving the goals of innovation, engagement and internationalisation. The experience described here demonstrates that ongoing innovation involving learning technologies can be supported by the convergence of a number of theoretical concepts, many of which pre-date the learning environments now available. Reflective practice has in this accounting subject made a useful and perhaps unique contribution as it has required the incremental aspects of the educational endeavour to be revisited and discussed in collaboration with a wide range of stakeholders including, most importantly, the students. It is suggested that the methodology involved in the process described here is of the utmost importance and deserves more attention than it is currently being given in the context of accounting education, as a means of facilitating ongoing, incremental improvement to the quality of online teaching and learning.

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VIRTUAL LEARNING IN THE WORKPLACE: THE POWER OF 'COMMUNITIES OF PRACTICE'

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Abstract

This paper explores how a virtual learning environment (WebCT) can be used to facilitate learning within a 'community of practice' on a Postgraduate Diploma in Management by work-based learning at Coventry University, England. The paper is part of a wider investigation into the use and efficacy of online support in work-based learning environments being carried out at Coventry University. The aim of this wider research is to develop a pedagogy for effectively integrating online support into the design of work-based learning programmes. In this current paper the theory of 'situated learning', that underpins the approach, is explored and evidence from in-depth interviews, focus groups and electronic discussions are considered in order to explore the success of the situated learning in a virtual combination of university, workplace and the wider professional and academic community. The paper concludes with remarks about the power and effectiveness of the approach.

Keywords
communities of practice, collaborative learning, situated learning, virtual communities. virtual learning environment (VLE)

Introduction

The research is set within a broad social backdrop in which technology is facilitating a change in working patterns towards more flexible home-based or multi-location working where virtual learning and development are key requirements. The work addresses a changing business and economic environment in which the educational emphasis is moving towards the provision of transferable generic skills and more vocationally orientated curricula delivered using more flexible teaching methods. In this paper I mirror these developments by examining a mode of education that brings together the use of a VLE with a more flexible approach to learning. The main thrust of the paper is the application of 'situated learning' theories to this new work-based approach to education in which communications and information technology (C&IT) are utilised to the full.

Historically, work-based learning programmes were not developed with on-line support in mind. Previous research on the integration of technology into the curriculum (Laurillard, 1993 & 1995; Conole & Oliver, 1998; McConnell, 2000) indicates that it requires a complete rethink from first principles in course design and delivery. The Postgraduate Diploma in Management at Coventry University (PgD) has been pedagogically re-engineered to create a virtual community of practice as the main arena for learning. This follows the theoretical approach of Lave and Wenger (1991) who argued that learning is a function of the activity, context and culture in which it occurs (i.e., it is situated). Thus, according to Lave and Wenger, social interaction is a critical component of situated learning as learners engage with a community of practice which embodies certain beliefs, behaviours and intersubjectively held knowledge. In this research I look at how this social interaction can be facilitated on the PgD using the online support afforded by the VLE WebCT. Firstly, in order to contextualise the research an appreciation of the course design is required.

The Postgraduate Diploma in Management (PgD)

The postgraduate diploma has the classical features of a work-based programme. It has a negotiated curriculum, autonomous learning, a focus on experiential and reflective processes, and is designed to develop transferable cognitive and lifelong learning skills. The course can be represented by figure 1.

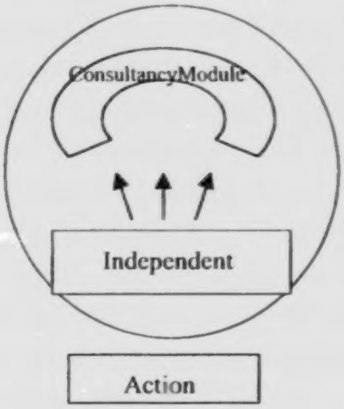

Figure 1: The postgraduate diploma in management - course structure

At the heart of the course is a double module of Independent Study. Alongside this double module is a compulsory 'Consultancy Module' that involves the students in carrying out a group assignment in a real business organisation. These three modules are encapsulated within a framework of 'action learning' in which students meet monthly in action learning sets to support each other in their projects and assignments. The attendance pattern and student support involves:

- Two 2-day Residentials
- Monthly Action Learning Set meetings (ALS meetings)
- Online Support via WebCT

The residentials are held at the commencement of the programme in order to allow course induction and a re-orientation of the students to a new educational experience. As Boud (2001) points out, a considerable effort in briefing students and orienting them to the demands of work-based study is necessary. Many have in their minds a model of education that is organised around academic disciplines, with a syllabus and content delivered through lectures and seminars in the traditional way. This is not the case with work-based learning.

The monthly action learning sets provide an opportunity for emotional support, a forum for social interaction with peers, and an arena for public reflection. The power of action learning is well documented (Pedler, 1991; McGill & Beaty, 1995). In the context of the postgraduate diploma action learning provides the backbone of the learning, and the function and process of the set forms a major component of the community of practice described later.

Central to the delivery of the course is the use of the integrated virtual learning environment (VLE) WebCT. This tool, which supports all 2000+ modules at Coventry University, provides a platform on which the online support for learners is facilitated (Deepwell & Syson, 1999). WebCT provides all the normal features of a VLE such as Email, bulletin boards, chat rooms, contents areas, www portals, electronic library, online assessments, student marks etc. etc. However, I feel the most valuable feature of WebCT, which is central to the support given to the participants on the PgD, is the asynchronous bulletin board which facilitates computer-mediated conferencing (CMC).

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The asynchronous conferencing allows the learning process in operation at the monthly face-to-face ALS meetings to be continued in the weeks between. Before outlining the methodology used in the research I will briefly discuss the theory of situated learning that underpins the work.

Situated Learning

Jean Lave and Etienne Wenger introduce the concepts of situated learning and communities of practice in their influential (1991) book , '*Situated learning: Legitimate peripheral participation*'. In this work, Lave and Wenger undertake a radical rethinking of the conception of learning. They argue that most accounts of learning ignore the basic social nature of the learning process. They propose that learning is a process of participation in communities of practice: with the participation at first legitimately peripheral but gradually increasing in engagement and complexity. Their analysis presents a radical critique of contemporary views of pedagogy and represents a new understanding of learning that has wide implications for course design.

Lave and Wenger (1991) provide an analysis of situated learning in five different settings: Yucatuc midwives, native taylors, navy quartermasters, meat cutters and alcoholics. In all cases there was a gradual acquisition of knowledge and skills as novices learned from experts in the context of everyday activities. There was little observable teaching; the more basic process was learning by engagement with the community.

From their research they define a community of practice as a group of practitioners who jointly hold a socially constructed view of the meaning of their subject knowledge and what it takes to be an expert in the field. The term 'community' does not necessarily imply co-presence but suggests a group who participate in an activity system about which they share understandings concerning what they are doing and how it should be done.

This model of learning emphasises the inherently socially negotiated quality of meaning and claims that learning and knowing are embedded in the relations and interactions of people engaged in activities within their socially and culturally structured world. Learning becomes a social practice in a world of jointly constructed meaning and knowledge.

The model begins with newcomers to the community being granted legitimate peripheral participation as a means of both absorbing and being absorbed in the culture of the practice. From this peripheral perspective learners gradually construct a general idea of what constitutes the practice of the community. Legitimate peripheral participation is the core of the learning that takes place. This peripheral activity gives rise to a *learning curriculum* which is a series of learning experiences available to the peripheral learner within the community of practice. The learning curriculum is thus '*situated*', in that it cannot be considered in isolation or analysed apart from the social relations that shape legitimate peripheral participation in the community.

A quote from Lave (1999, p. 68) nicely encapsulates the process.

> *Newcomers become oldtimers through a social process of increasingly centripetal participation which depends on legitimate access to ongoing community practice. Newcomers develop a changing understanding of practice over time from improvised opportunities to participate peripherally in ongoing activities of the community. Knowledgeable skill is encompassed in the process of assuming an identity as a practitioner, of becoming a full participant, an oldtimer.*

The model sees learning as a transformation of newcomer to oldtimer rather than a process of transmission of skills from tutor to pupil. In addition, it alters the normal Piagean conceptualisation of learning from something that takes place in the individual mind, as an accommodation of new mental models and structures, to something that takes place in a participation framework. Learning is, within this model, distributed among co-participants, not a one person act. Social constructivism (Vygotsky, 1978) is the key process at work. Social constructivism broadens Piaget's view of individuals constructing knowledge and poses the question, *is the 'mind' located in the head or in social action?* (Cobb, 1994). If the mind resides in our heads then we can think of learning as ***acquiring*** knowledge; if the mind is influenced and shaped by society, social action and social responses - as in a community of practice - then we can think of learning as **participating** in knowledge held jointly by the community.

As Lave and Wenger (1999) state in their contribution to Leach and Moon's book, *'Learners and Pedagogy'*, if the novice does not learn directly from the expert but from peers and the rest of the community then knowledge can be considered not to reside in an individual but to reside within the community as a whole - *mastery resides not with the master but in the organisation of the community of practice of which the master is a part.* This decentering of the learning process moves the focus of the learning away from pedagogy and the skills of the master to the efficacy of the community's learning resources. Thus the problems for the university tutor are not those of pedagogy – how best to teach – but problems of how the community of practice involved can be replicated within the confines of the university's learning environment. This is the issue I am exploring within this paper.

Methodology

The work has been carried out within an action research framework (Carr and Kemmis, 1986; McNiff, 1988; Elliot, 1996). I have taken a stance as an 'insider researcher' and endeavoured to collaborate with the learners on the PgD in an effort to understand the student experience. The work has centred on a change intervention (the introduction of an online learning environment for work-based learning) which has been watched and examined for its impact. Several cyclical iterations of the research have been planned; this paper represents the results of one of them based on a preliminary analysis of the data.

Firstly, I analysed the content of the conference messages on the bulletin board. The WebCT bulletin board stores every message posted and allows a printed compilation of every piece of information entered into the system. I concentrated on understanding the nature of the online communication and the purpose the sender intended for the message. Having reviewed the vast array of methodologies available for analysing communication patterns (Holsti, 1968), I decided that, at this stage, a simple content analysis was most appropriate.

CMC messages have distinct characteristics (Mason, 1993). Unlike text records acquired independently from respondents through interview or diary methods, CMC messages are produced in collaboration with others and as part of an asynchronous interchange. The vocabulary and style of CMC is different to that of formal writing or informal conversation: it is a hybrid *'computer-speak'* that is half way between the two. The inclusion of the abbreviated 'text-message format', so popular with modern mobile phone users, adds a further uniqueness to the data. Beadin (1999) notes that this type of computer-speak should be encouraged since learning online increases when learners are allowed to discuss issues in their own way without being manipulated or controlled. For my analysis I printed out all the contributions to the PgD CMC and then used 'contribution clusters' to group the messages. I defined a contribution cluster as a theme within the messages that signified a meaning and purpose intended for the contribution.

To triangulate the data I carried out focus groups and in-depth interviews to improve my understanding of the participant's experiences and intentions. As Morgan (1988) points out focus groups can provide a rich source of qualitative data. For analysis purposes I made a TV video recording of the focus groups and further recorded participant's contributions by using rich pictures. These involved the focus group participants making a pen and paper drawing on flip chart paper that represented their online experience on the PgD. Group members then spoke to these drawings elaborating on their intended messages. Unstructured in-depth interviews were also carried out with a number of learners to explore their feelings and intentions in more detail.

The focus groups and in-depth interviews allowed further interrogation of the issues that emerged from the content analysis of the CMC postings. Gradually a picture emerged that gave me an overall understanding of how learning was taking place in the virtual community I had created.

Discussion of Results

The research project is not yet complete but my preliminary analysis of the data points to an interesting explanation of the learning process in action.

In accordance with the theory underpinning the research, to become a full member of a community of practice requires social interaction with, and access to:

- A wide rang of ongoing authentic activities
- Old-timers
- Peers and other members of the community
- Relevant information
- Learning resources
- Opportunities for participation.

So, how much of this is provided by the course? Clearly the workplace provides authenticity and the PgD activities allow participation. The social interaction and collaboration are provided by both the action learning set activity and the collaborative assignment required in the consultancy module. The relevant information and the access to learning resources are provided by the WebCT study web. But, is the recipe complete? What community of practice is being joined and how is it replicated in the course's overall learning environment?

In trying to answer this question the research suggests firstly that the community of practice does not reside in the student's workplace. Respondents made it clear that, although some expert practitioners were present in their place of work, in general, they were not surrounded by expert colleagues. In some instances – for example in the case of a company accountant – students were the only practitioner in their discipline. Students did have company mentors who were a source of support and advice, but in general, the respondents agreed that the community of practice resided beyond the workplace environment.

Secondly, the tutors on the course made no explicit attempt to artificially construct a community of practice. This would have limited the social construction of the student's arena for learning to the interpretation of the community of practice that the tutors held: clearly a bounded scenario. The students on the course were from very diverse backgrounds and had very different learning objectives for the course. It would not have been possible for the tutors to construct multiple communities appropriate for each student's needs. Constructing an appropriate community of practice was beyond the bounds of the tutors and would not have achieved an authentic learning situation.

Having ruled out the two obvious explanations of the nature of the learning community, the picture that emerged from the data was one in which the community of practice existed from a mixture and combination of the following:
See Figure 2.

- The social interaction between the learners on the course
- Social interaction with mentors and some expert colleagues at work
- Contact with tutors and university academics
- Engagement with academic literature/resources
- Collaboration with other learners
- Exposure to how other managerial experts operate

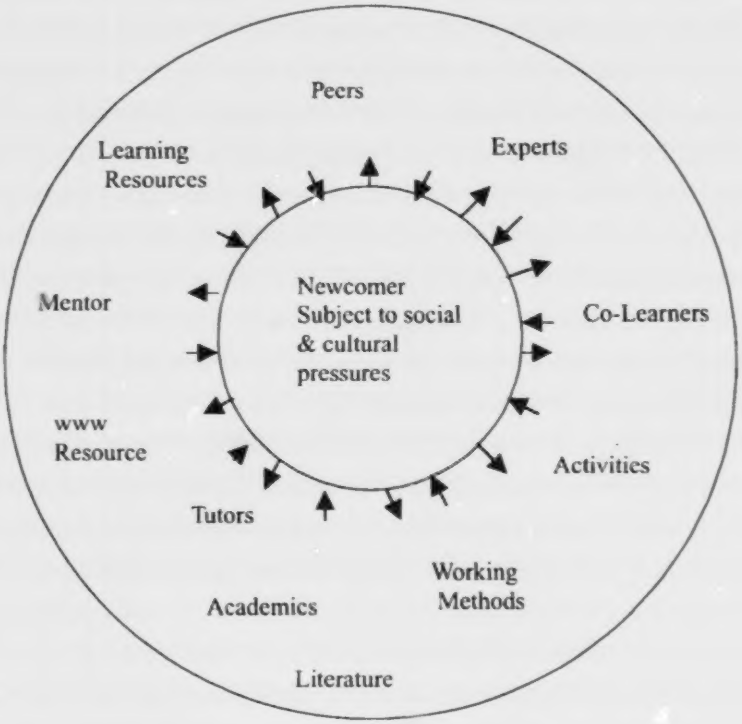

Figure 2: The virtual community of practice on the PgD

The research supported this picture of the community in several ways. Respondents talked repeatedly about the value and richness of the support received from their peers and co-learners.

> *'the action learning set was the most supportive part of the course',*
>
> *'it was useful seeing how other members of the set challenged my ideas and made me think differently',*
>
> *'without the support of my fellow students I think I would have given up the course.'*

The emotional and academic support afforded by action learning sets is well documented, but clearly, within the learning context provided by the course, this feature was regarded very highly by participants.

The various assignments on the PgD created numerous opportunities for legitimate peripheral participation in the workplace. Students reported that being on the course gave them a licence to explore and engage with areas of their business that stretched their expertise. Mentors and expert colleagues gave them time and advice in a fashion similar to;*'master and apprentice'*, but in a more socially engaging manner. The contact was more routine and everyday, without any hint of a power differential.

The CMC facility allowed constant interaction with university academics and co-learners from a much broader society of managerial practitioners. Asynchronous conferencing within the WebCT study web and other '*listserve*' type external discussions brought a dimension to the students' interactions that could be described as "academically and socially stimulating".

'the bulletin board allowed me to keep in touch and stay focussed',

'electronic resources posted by others gave me heaps of ideas for my project',

'I checked the web every day and found it motivated me to contact others on the course.'

From the analysis of the CMC transcripts it was clear to me that the collaborative nature of the consultancy assignment created the highest degree of legitimate participation and reflected the whole ethos of the situated learning process. The teamwork involved and the need to engage with a real, live business problem allowed a level of authentic participation that, through cultural and social interaction with the players concerned, provided a rich social experience. The transcripts suggested that students learned by doing, but more than this, they collectively built a body of knowledge about the organisation and its problems which was held by the group, not by one individual. No one single member held all the answers; they were creating a microcosm of the community of practice they were aspiring to join. The learning taking place at the micro level on this one assignment mirrored the situated learning ethos of the whole course.

Concluding Remarks

Having reviewed the theory and the results associated with the PgD what can be concluded about learning in virtual communities of practice on the web?

The communications revolution brings a new form of social existence and with it a new opportunity for learning. Boden and Molotch (1994) have argued that co-presence is so important to communication and social relationships that when it cannot be achieved anything else is second best. They state that when people can't actually secure a state of co-presence, they strive to approximate it as best they can by using the telephone or internet. While face-to-face communication has a unique richness and range, impossible to simulate on the web, when it comes to learning through social and cultural mechanisms of interaction and participation, this study has shown that virtual communities of practice can compete. The dispersed nature of both the community and the knowledge held atomistically by its members makes WebCT an ideal tool to trawl the various depositories of knowledge in a sequence of legitimate activities that brings an ever increasing confidence and expertise for the student.

Stone's (1992) paper can also help to contextualise the results and take a wider view of the findings. Stone reflects on the dispersed nature of knowledge and practices and gives a useful definition of virtual communities; *...passage points for collections of common beliefs and practices that unite people who are physically separated* (Stone, 1992, p. 507).

The definition builds on Lave and Wenger's (1991) definition and encapsulates the view that a virtual community is a socially and culturally structured world involving physical separation. Despite this lack of co-presence Stone outlines numerous examples in which virtual identities and cultures have been achieved in a solely text based medium. He argues the positives and negatives of virtual communities but illustrates the power of the interactions in creating reality for the participants. The research indicates that it is this reality that participants on the PgD have been experiencing within the combination of university, workplace and the wider professional and academic community. The results suggest that the virtual community of practice has provided an arena in which students have been able to develop their identities as practitioners and scholars in a supportive and challenging environment.

To conclude, the study has indicated that the ethos and requirements of situated learning can be created virtually with possible benefits for work-based learning students. I would suggest that in the higher education sector the power of situated learning needs to be considered further, so that course designers can turn revised pedagogy into curricular in which the new technology is coherently and effectively embedded. Only in this way will the real power of the community of practice be realised.

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CREATING AUTHENTIC TECHNOLOGY ENVIRONMENTS FOR IMMERSIVE LEARNING

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Abstract

This paper argues that traditional teaching methods in computer science do little to prepare students for the demands of the IT industry, where they are required to problem solve to meet the rapid changes in technological innovation, and to work in creative and responsive teams. It describes an approach taken in a new computer science degree at The University of Queensland, which is firmly embedded in learning-centred pedagogy. The educational design of the degree emphasises active, interactive and collaborative learning on the part of students. In this degree, students work as a community of learners, interacting to solve design problems. Courses provide a team-based environment for technical development and implementation, rather than the traditional inflexible, sequential and compartmentalised IT development methods found in most computer science degrees. This paper describes uses of technology that differ from current computer science education practice. Typically, technology application is thought of in terms of resources used to deliver effective teaching. In this paper we describe a course which immerses students in the evaluation, design and construction of technological constructs to achieve certain outcomes.

Keywords
computer science, technology for learning, collaborative learning, studio approaches

Introduction

The Information Environments degree at UQI represents a major departure from traditional didactic computer science teaching methods and embraces learning-centred pedagogy as a means of achieving improved learning outcomes and transferable skills. The Information Environments program focuses on the human side of computing, particularly on how people in different locations communicate and share information on networked systems and devices. The degree is a design-focussed, studio-based program, which emphasises the crucial importance of cognitive skill development in the areas of problem solving and critical thinking for computer science students. An end-user focus and teamwork emphasis are also central themes of the program.

The Information Environments program recognises that it is no longer sufficient to pursue inflexible, sequential and compartmentalised IT development methods or to focus on delivering content in relative isolation of the contexts in which it is to be applied. Brown, Collins & Duguid,

(1989) argue that this separation of content (what is to be learned) from context (how it is learned and used) will not result in deep learning. Students can 'acquire', and even manipulate, algorithms, routines and de-contextualized definitions, but this does not mean that they will be able to apply them to new contexts. Lave (1996) also argues that learning is a process that takes place in a participation framework rather than in an individual's mind. Software engineering skills that have been taught in isolation result in little transfer to new contexts, and, an added complication is that, given the rapid developments in technology, the content and skills presented to students in this way are likely to have changed almost before graduates have reached their first jobs.

Brandsford, Sherwood, Hasselbring, Kinzere and Williams (1990) found that many software engineering students face difficulties when it comes to problem solving – they often have no idea where to begin, despite their familiarity with the syntax of programming languages. They can memorise facts and procedures, but have difficulty in explaining observed phenomena, or solving real-world problems or analysing problems and thinking critically. Many of these students may pass examinations, but have trouble generalising their learning from one situation to another, leading to a skills gap every time the job, content or technology changes. Future employers expect computer science graduates to be able to meet the rapid changes of technological innovation, and to work in creative and responsive teams. Traditional teaching methods do little to prepare students for these demands.

Studio-based Teaching and Learning

The majority of IT degrees typically include a single undergraduate subject concerned with user-focussed development and human-computer interaction issues. In contrast, the Information Environments program is educating IT students with a human factors and design-first pedagogy, achieved through a 'Studio-based approach' to teaching and learning. The 'Studio' enables a community of learners to interact to solve design problems. The 'Studio approach' offers students an opportunity to solve real design problems in ways that mirror the work of professionals in the world of information technology: through team work, collaborative learning and the application of related knowledge to new contexts (Docherty & Brown, 2000). Knowledge and skills are acquired in context rather than as separate segments 'to be learned'. This approach closely relates to social constructivist theories of learning (Jonassen, Davidson, Collins, Campbell & Haag, 1995) which argue that learning is necessarily a social dialogical process in which communities of learners socially negotiate the meaning of the phenomena. Meaning is constructed through collaboration and conversation by the learners, rather than through the passive receipt of 'uncontested knowledge' delivered in a one-way flow of information by the lecturers. The emphasis on 'Studio' as a physical and virtual place provides a context for work on physical and virtual outcomes and deliverables. Studio courses integrate learning from design and IT courses in the program.

Studio IV occurred over a period of thirteen weeks and was the fourth Studio undertaken by second year students in the Information Environments degree. The emphasis in Studio IV is on the production of working prototypes based on research and ideas. It was designed to explore information environments from the perspective of invisible or ambient computing technology. This is in contrast to the current genre of PC workstation applications that is the dominant focus of computer science education initiatives. The ambience domain was chosen to encourage students to examine new ways of communicating and interacting with information through unique technology solutions. The abstract nature of invisible computing prompted the need to provide a tangible and physical focus in order to achieve the learning outcomes mentioned above. A virtual café was chosen to be the information environment of interest for the duration of the course. Human experience was emphasised within this context. Off-the-shelf hardware such as sensors, microphones, lights, speakers and smart circuit boards were to be combined with software applications to design and build physical demonstrations of a café concept.

The students proceeded through various phases requiring both individual and group contributions to the overall project. These phases were modelled on typical IT industry practice based on the lecturers' industry experience. This course was taught by two lecturers who took roles within the scenario as development manager and client, rather than traditional lecturing roles. This entailed managing the students as a development team, inspiring them to present solutions to the 'client' as the project progressed. The initial phases of the project were conducted in groups of four students. Their tasks included ethnographic observation and interview of café user groups, physical/virtual problem and opportunity analysis, and information flow evaluation. This research of the different types of users in the café scenario provided the students with a set of needs and problems that they could design solutions. For example, owners were consistent in identifying that changing menus and 'specials' was a problem for them and was a significant cost to them.

The next phase entailed making individual preliminary design proposals, physical and virtual design mock-ups that would satisfy the user needs identified. Hardware technology was also evaluated and the students presented ways of applying them to satisfy user needs (user centred design). The designs were evaluated in terms of suitability for creating an overall café experience that demonstrated notions of ambient and invisible computing to a lay audience. The reality of constructing the designs within the allotted time for the program was also considered which is typical of industry practice. Both students and lecturers participated in a review session to determine the most feasible alternatives.

The development of the virtual café software followed a practice called eXtreme Programming (Beck, 1999, 2000), involving user story cards, pair programming, task assignment, time estimates and test case development. This is a highly learner-centred and activity-focussed approach and it was selected because of its emphasis on rapid, nimble, iterative development with a strong user focus. Students took intimate ownership of the outcomes resulting in a deeper appreciation of the rationale and application of effective design processes and methodology.

Outcomes

The final result of the students' efforts was a physical manifestation of the software code and hardware configurations that they had developed throughout the semester. The software that was developed enabled hardware such as touch and motion sensors, microphones, lights, interactive whiteboards (SmartBoards), projectors and speakers to create a unique café experience. During the evening that the café was set up for inspection, it was very evident that student learning went far beyond the classroom learning outcomes. Students fielded questions about their designs and were engaged in discussions with IT professionals reinforcing the reality of what they had researched, designed and built. In most cases, the discussions centred on user interaction and value rather than on the technical achievements. From a technical perspective, the achievement of having the students build the prototype should not be under-stated. The software that was developed by the students through this process enabled hardware such as touch and motion sensors, microphones, lights, interactive whiteboards (SmartBoards), projectors and speakers to communicate to create the unique café experience. The idea of building things in contrast to cursory code reviews appealed to the students and was reflected in their course evaluations.

Also, the students did not need to be taught to configure technology in new ways to create the effects they had researched and designed. They had an inherent desire to see the results of their research come to fruition. Other examples of technology application were: chairs signalled when they were occupied, microphones picked up the level of sound in the café and this 'ambience' was represented as graphic images on a remote sign, live camera images of guests were displayed and could be streaked and altered with the stroke of a finger on a display board.

In our experience, the impact of the students' work would have been severely minimized without the overall context of the café and information environment focus afforded by the flexibility of the Studio delivery process. The technology infrastructure associated with the campus also allowed students to pursue their passion for the project as many times they worked remotely into the night uploading and downloading code from the central repository.

Conclusion

Students in Studio IV achieved outcomes that clearly differentiate their learning experience from students taught by more didactic methods. A course evaluation was completed by the students with results in the top quartile in all categories. The majority of the comments offered by the students were positive. An enhanced ability to work in teams was one of the major outcomes, with students reporting a sense of individual satisfaction in a team context by making a contribution to a shared vision. So committed were students to successfully developing the ambient café demonstration, that they performed critical set-up and integration tasks after all assessments for the course had been completed.

There was also evidence that students' oral presentation skills improved over the course. This was as a result of making frequent, informal presentations of design ideas or development status. These presentations had authenticity, being intimately and realistically associated with the context of the task, in contrast to traditional presentations which often require students to make isolated topic-centred, high pressure, seminar-style presentations for assessment purposes. The traditional confusion over the boundary between collaboration and collusion did not exist in this course. In the spirit of real-world development initiatives, students were rewarded for reuse and sharing, contrary to typical IT learning environments where similar code raises issues of collusion and penalties.

By creating a learning environment where students could maximise their engagement in learning through discussion, clarification of ideas, considering alternatives and monitoring their own understanding. In addition they were able to compare points of view with those of others and negotiate work practices; the students were able to forget they were being taught, but were aware that they were learning. Their learning was a product of this ambient collaborative culture rather than of explicit teaching. Anecdotally, they acknowledged the importance of the teamwork aspects of the course and they expressed a preference for working on this course to the detriment of other courses. They competed positively, building on each others' ideas rather than being critical or defensive about suggestions for improvement.

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TOWARDS A PEDAGOGICALLY SOUND BASIS FOR LEARNING OBJECT PORTABILITY AND RE-USE

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Abstract

The issues of portability and re-use are key challenges for learning technology. A major effort has been directed towards the development of standards that will enable interoperability and the re-use of 'learning objects'. The paper provides a critique of this work from a pedagogical perspective. It argues that true portability and re-use cannot be achieved based solely on a technically inspired drive towards standardization. A theoretical framework is required that will guide the process of analysis and synthesis. This paper proposes the basis for such a theoretical approach based on the concepts of layering and learning contexts. A formal approach to capturing the essential features of these learning contexts is outlined, based on the idea of 'design action potential' networks. The choice pathways in these networks represent a formal description that may be fed into the standardization process. The ensuing descriptive data, attached as metadata to learning objects, would provide a pedagogically informed basis for interoperability and re-use.

Keywords
e-learning, metadata, standardization, portability, re-use

Introduction

Educational and training institutions have expended considerable energy on developing computer based educational material, which can take the form of anything from a simple file to a full set of online courses. Globally, e-learning is estimated to be worth $365 Billion by 2003 (Moe & Blodgett, 2000). Major UK public sector developments alone include the University for Industry, the National Grid for Learning, the e-university, and the Distributed National Electronic Resource (online). However, there is a fundamental problem in the fragmented and disjointed way these materials are structured and stored in online resource repositories. From the user's perspective, the potential offered by all of this content is diluted by the disjointed, poorly structured manner in which material is being placed online. From an organizational perspective, the structural deficiencies may act as a disincentive to investing in large-scale e-learning solutions. Essentially what is needed are standards that allow educational materials to be reused in an educationally meaningful way.

Reusability in e-learning presupposes that educational materials are described in a systematic way that facilitates the identification and integration of various learning materials. This leads naturally to ideas of standardization and classification. However, standardisation is particularly difficult to achieve in inherently decentralised domains.

The first part of this paper provides a selective, critical review of the major standardization initiatives based on the concepts of 'learning objects' and metadata. This work has been developing a technical basis for the re-use of learning materials. The work aims to produce a basis for interoperability. Interoperability is here defined primarily as the ability to operate multi-vendor components together using a common set of protocols or standards. The basic approach is to attach metadata, extra descriptive material, to learning objects to support location, description and re-use. This discussion on learning object standardization highlights the pedagogical weakness of the approaches adopted. It concludes that true portability and re-use cannot be achieved based solely on a technically inspired approach towards standardization. Standardization for re-use requires a pedagogically informed theoretical base to underpin the descriptive standardization process.

The second part of the paper explores the basis on which a theoretically sound approach to capturing pedagogical attributes may be developed. It proposes the basis for such an approach based on the concepts of layering and learning 'contexts'. It first outlines these concepts. The paper then explores their potential contribution to enriching the formal standardization process.

Critical Review of Work on Learning Object Standardization

The current state of play in terms of standards for the repositories of learning objects is problematic. Content is currently described using a wide range of standards and specifications, including a confusing mix of emerging international specifications (Miller, 2001). Important developments in this field include the IMS Metadata Specification (online) and closely related LOM from IEEE (online), the Dublin Core Metadata Element Set (online) and proposed educational extensions (online), and locally developed alternatives. These technical problems are obscuring a more fundamental pedagogical problem, namely that these standards have barely considered how to underpin developments in a theoretically sound way.

The standards developed are based on the idea of attaching metadata to learning objects. Metadata is 'data about data'; it involves the addition of extra information that describes the nature and structure of the learning object. The metadata should allow computers processing software to 'understand' the structure of a resource and the relationship between the objects inside the resource. This would facilitate resource discovery:

> "The association of standardized descriptive metadata with networked objects has the potential for substantially improving resource discovery capabilities by enabling field-based (e.g., author, title) searches, permitting indexing of non-textual objects, and allowing access to the surrogate content that is distinct from access to the content of the resource itself." (Weibel & Lagoze, 1997)

The metadata attached to learning objects should also provide information to support the re-use of objects. To achieve these twin aims a metadata model is required. Such a model describes the learning object structure, and needs to be applied when the resource is created. Should another course author wish to reuse a particular learning object, they first need to locate it (resource discovery). Thus, the same metadata model that was specified when the object was created is used when a search is performed to locate appropriate resources. The metadata should then provide information to support the re-use of the learning object in the new setting. Within one resource, e.g. a local database, it is easy to enforce a particular metadata model. However, when one considers the number of resources in a multitude of dissimilarly structured repositories residing all over the globe, and in a variety of different human languages, then the problem increases exponentially in complexity.

Solving the complex task of finding and using disparate sets of learning objects is described as interoperability. Interoperability is a precondition for reusability; it supposes a framework or language-like structure in which the meanings of dissimilar metadata descriptions could be conveyed between two or more systems. True interoperability would free the course construction activity of time consuming search and crop-to-fit exercises (i.e. customizing located material to fit the educational objective at hand). The assumption is that the objects within the resource could be described to stand alone as well as to be a part of a bigger object, which in turn could be contained by a bigger object, and so on. This flexibility would grant the possibility of construction of entire courses by integration of various sets of metadata referenced materials. One author's effort could be integrated in numerous learning systems. However, the question as to whether this would improve the overall quality of learning materials is not clear. A full review of the general approach to inter-domain interoperability is beyond the scope of this paper. Interested readers are referred to EASEL (online) for more information

There is a significant problem with current approaches. These approaches to standardization have taken a strongly technological approach to solving the problems of reuse and recombination. Learning objects are described as 'pedagogical neutral' (Cowley & Wesson, 2000). The formal descriptions (metadata) do not have a strong pedagogical base. Metadata provides ways of locating objects and linking them like pieces in a jigsaw. There is no guarantee, however, that the jigsaw will make pedagogical sense. The metadata information may be extended to include information about the instructional role of the learning object (Hepburn & Place, 2000). However, there are limitations to the use of adding descriptive data without a clear theoretical base.

Towards A Pedagogically Sound Base for Re-Combination and Re-use

The paper now turns to the issue of how such a theoretically informed approach to the analysis and description of 'learning 'objects' might be derived. The first problem is that the concept of 'learning objects' is theoretically weak. We need a better understanding of how we might conceive of computer based learning entities (the term 'entity' is chosen to be as general as possible at this stage). This paper will discuss two major issues in developing the proposal for a better-informed approach to analysis and re-use:

- the conceptual representation of 'learning entities'
- relationships between learning entities

The Central Explanatory Construct For Capturing E-learning Artefacts

'Things separate from their stories have no meaning'
The Crossing – Cormac McCarthy

Hodges and Sasnett (1993), arguing from a film theory perspective, have proposed that context is the natural unit for understanding and representing computer-based multimedia environments. They initially compare a computer-based environment to a scene in a film. The key difference in a computer-based situation is the addition of interactivity. They argue that the concept of 'context' can both capture concepts from traditional film theory and enhance this understanding through the addition of the concept of interactivity. From this perspective a context might be visualized as an interactive scene.

Boyle, approaching from a different perspective influenced by psychology and linguistics, proposes that computer-based learning entities should be conceptualized not as things (objects) but as learning 'contexts' (Boyle 1997, 2000). Context is here defined as a construction that makes selective, holistic sense of the environment of interaction. This 'construction' guides adaptive action in the environment. This concept emphasizes the central role of appropriate activity. The central challenge for educational multimedia designers is to create contexts that promote effective interactive learning. Specific guidance on how to achieve this goal is given in several contributory disciplines, especially linguistics, situated action theory, film theory and psychology. The contributions from film theory, linguistics and psychology are developed in some detail in Boyle (1997).

The influences from psychology and film theory provide a rich base for articulating learning contexts. However, it is the input from linguistics that provides the basis for the formal description that is necessary to capture their essential features. Systemic Linguistics views natural language grammar as derived through a series of abstractions from the use of language in context. It has developed a formal systematic representation of this (context grounded) deep grammar based on 'systemic networks' (Halliday, 1973, 1975). Boyle (1997) adapted this approach to develop a method of capturing the design choices built into computer-based learning environments. He argues that the creation of multimedia learning contexts involves the parallel choices made on three macro-functions:

- the *content structuring* macro-function: the selection and structuring of the learning content in the multimedia context;

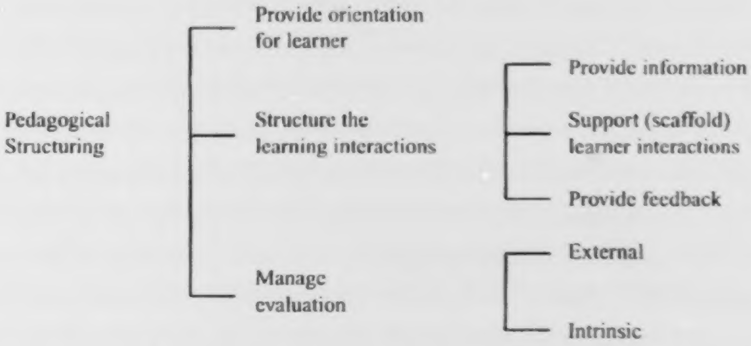

Pedagogical Structuring
Provide orientation for learner
Structure the learning interactions
Manage evaluation
Provide information
Support (scaffold) learner interactions
Provide feedback
External
Intrinsic

Figure 1(a): An initial analytic framework for pedagogical decisions

- the *interactivity* macro-function: designing for user interaction with this content;
- the *compositional* macro-function: the creation of a coherent overall composition, both within and across contexts.

Boyle proposes that these choices can be represented in 'design action potential' (DAP) networks that capture the design choices made. These networks follow a similar structure to the systemic networks used in linguistics to capture progressively more delicate levels of linguistic options. Choices on the three macro-functions are expanded in parallel networks. Figures 1(a) provides an example of the expansion of the high level 'interactivity' macro-function. Figure 1(b) expands the alternative options available under the 'Provide Orientation' node. Examples of expansion of the content structuring and compositional functions are provided in Boyle (1997).

There are strong correspondences between the first two macro-functions and the traditional educational concerns of curriculum (the structuring of the content to be learned) and pedagogy (the structuring of learning interactions). The macro-functions thus synthesize contributions from a number of significant contributory disciplines. These contributions tend to complement one another, and provide a richer picture for the e-learning designer. The third macro-function has no marked parallel in educational theory, but the contributions from linguistics and film theory help to fill out this concept.

It is not the role of this paper to go into a detailed exposition of this concept (see Boyle, 1997). However, it does point to a significant research challenge: how to capture in a systematic, unified knowledge base the sophisticated options in constructing educational multimedia contexts. This formal system could provide the theoretical base in providing an informed extension to metadata schemes which would capture the pedagogical richness of computer based learning entities. Such knowledge might be attached to re-usable learning objects to mark the choices of content structuring, interaction and composition they embody. This would greatly enhance the educational use of learning objects which are at present pedagogically limited (Cowley & Wesson, 2000; Hepburn & Place, 2000).

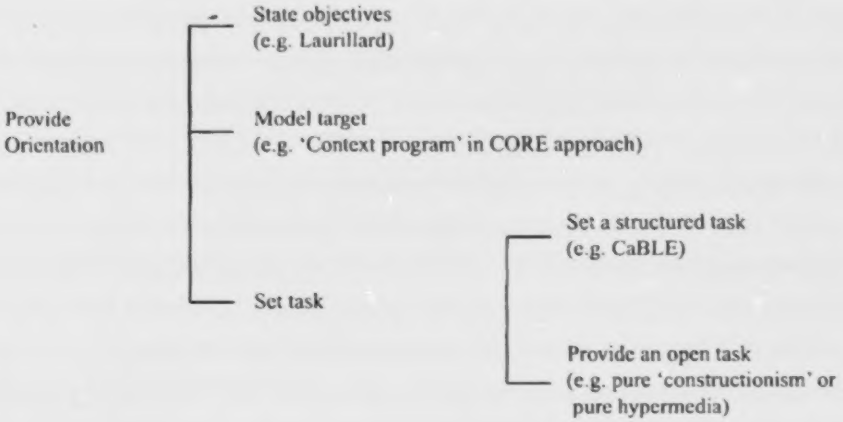


Figure 1(b): An elaboration of the 'provide orientation' function

Relationships between Learning Contexts

'... and each tale the sum of the lesser tales'

The Crossing – Cormac McCarthy

A second significant challenge is how to capture in a meaningful way the relationships between learning contexts. This is a rich topic. The aim of this section is to focus on one significant type of relationship rather than to explore this area fully. The 'learning objects' approach tends to be very eclectic in defining what a learning object is. It may be a whole module, or it may be a specific learning resource. The theme of this section is that there is considerable analytic power to be gained from analyzing learning objects into different layers, and in clarifying the relationship between objects at these layers. This section will illustrate how this may lead to a more powerful basis for the re-use of learning contexts.

The simplest 'layered' approach to re-use is 'resource-based learning' (Hall, Hutchings, & White, 1995). In this model there are basically two layers – a resource layer and a layer of use. Resources are held on computer systems; these may be searched by tutors for use in their classes. Tools, such as Microcosm, have been developed to support this process. Theoretically, this approach is weak. The human tutor makes all the key pedagogical decisions. There is little explicit pedagogical information captured about the resources at the computer/resource layer. The 'resource' layer, however, provides an important component of a more generalized approach to the layering of educational entities.

Boyle (2000) has outlined a minimum of three layers for capturing the pedagogical nature of computer based learning entities. The layers he proposes are:

Classware
Courseware
Resources

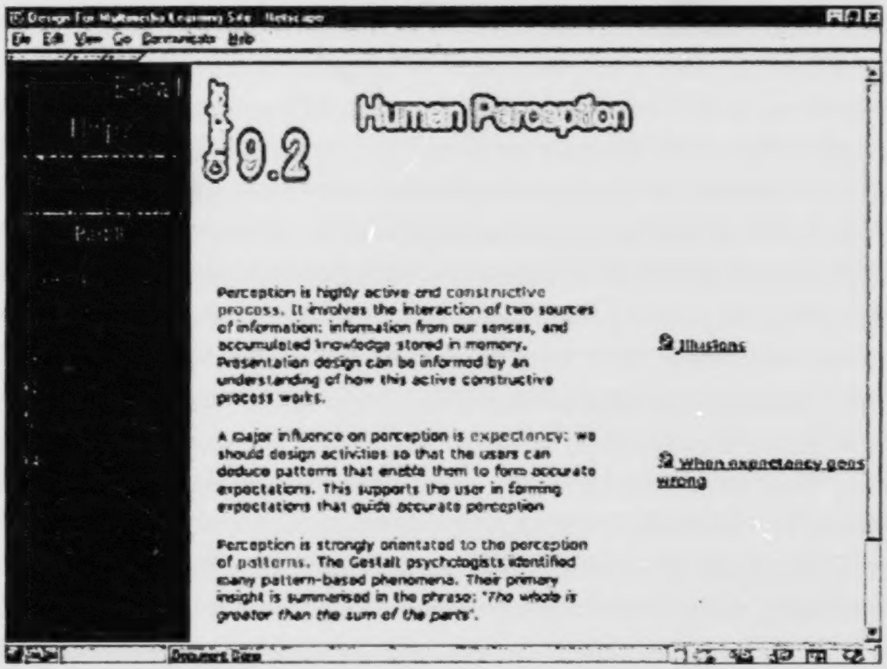
Courseware covers significant, self-contained curriculum areas, e.g. a set of web pages covering the content for a substantial part of a module that students are studying. For example, the CLEM system provided a fairly complete coverage of a first year university course in the programming language Modula-2 (Boyle, Stevens-Wood, Zhu, & Tikka, 1996). Resources are much smaller entities that deal with particular issues or functions.

This conceptual division might be best elucidated through an illustration of a system that is explicitly structured in this way.

Illustration of Layered E-Learning Contexts

The DFML Web based system (Boyle & Payne, 1999) was developed to complement the book 'Design for Multimedia Learning' (Boyle, 1997). Figure 2a is a screen from the system. The site was constructed to support very rapid navigation from a section in the book to the equivalent section on the Website. The site does not attempt to duplicate the book. It gives access to multimedia resources that expand and illustrate the abstract points made in the book. The panel on the left permits rapid drill down navigation to any section in the site (Figure 2a). The central panel then displays the key points from that section in the book. Opposite each paragraph there may be a link to multimedia resources that illustrate/expand on the key point made in the paragraph. The main context thus provides controlled access to other contexts, which have their own framing of content and interactivity. Figure 2b shows one of these contexts activated.

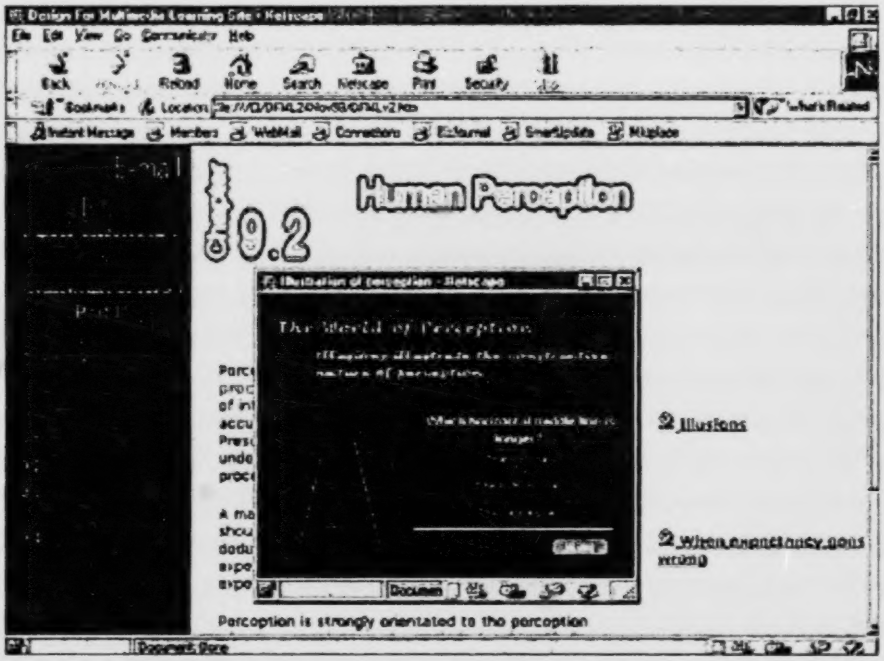
The DFML site is based on a very explicit 'levelling' of contexts. The main site operates at the courseware level – it covers a substantial curriculum area for a module on interactive multimedia design. The 'micro-contexts' act at the next level down – 'resources'. These learning contexts deal with specific themes or issues, e.g. using illusions to illustrate the active nature of perception. The interface between the two levels is kept very clean. It is managed through specific links kept on a separate part of the courseware context screens. This greatly aids portability and re-use. The resource contexts can all be used independently from this particular courseware context.


Design For Multimedia Learning Site - Netscape
File Edit View Go Communicator Help
E-mail
Help
Back
9.2
Human Perception
Illusions
When expectancy goes wrong
Document Done

Perception is highly active and constructive process. It involves the interaction of two sources of information: information from our senses, and accumulated knowledge stored in memory. Presentation design can be informed by an understanding of how this active constructive process works.

A major influence on perception is expectancy: we should design activities so that the users can deduce patterns that enable them to form accurate expectations. This supports the user in forming expectations that guide accurate perception

Perception is strongly orientated to the perception of patterns. The Gestalt psychologists identified many pattern-based phenomena. Their primary insight is summarised in the phrase: '*The whole is greater than the sum of the parts*'.


Design For Multimedia Learning Site - Netscape
File Edit View Go Communicator Help
Back Forward Reload Home Search Netscape Print Security Stop
Bookmarks Location What's Related
9.2
Human Perception
Illustration of perception - Netscape
The World of Perception
Illusions
When expectancy goes wrong
Perception is strongly orientated to the perception
Document: Done

Figures 2 (a) and 2 (b): The DFML screens

The courseware context in turn 'plugs in to' the (higher level) classware level context, as exemplified in a VLE such as WebCT. This permits the multimedia courseware context to be incorporated in a wider virtual classroom with organized discussion groups, etc. The construction of learning contexts can thus be structured on a series of levels. If the interfaces between these levels are kept as simple as possible this greatly facilitates re-use and re-combination.

The purpose of this paper is to sketch a programme for tackling the issue of pedagogically informed portability and re-use. It is beyond the scope of this paper to go into a detailed unfolding of the primary theoretical constructs. It is, however, important to comment on the link between this type of theoretically informed analysis and the forms through which standardization is expressed. The DAP networks record formally the choices made in the design of learning contexts. They provide a theoretical base to work from. The full conceptual expansion of this base remains a research task. The precise descriptions generated by this task, however, would provide rich descriptions of pedagogical design features. These descriptions are highly amenable to capture in terms of the metadata structures used in standardization research. These contextual descriptions would greatly enrich the pedagogical information captured in the standardized metadata. It is proposed that these metadata extensions, together with the 'layer' marking of the learning entity, would greatly enhance the re-use and re-combination of learning 'objects'.

Conclusions

How to solve the 'analysis-synthesis' nexus that is the core challenge for the effective re-use of learning materials? This paper has provided a critique of the present state of the learning objects approach. The focus on learning objects is more on the 'mechanical' re-use of pre-formed chunks by selecting these from catalogues of learning objects. The theoretical weaknesses of this approach undermine its ability to solve the deep problems of re-use and re-combination.

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The paper has set out an analysis of some of the principal issues in tackling the problem of pedagogically informed re-use. It has proposed the notion of learning 'context' to capture the richness of e-learning environments. The design feature of these contexts may be captured formally in networks similar in structure to systemic networks in linguistics. The information captured in these networks provides a basis for extending the metadata about learning 'objects'. This provides a more informed basis for re-use. The importance of layering learning contexts has also been emphasized in separating contexts for re-use in different settings.

Building a firmer base for the re-use of computer-based learning resources requires a systematic and formal discipline. This process should not only lead to better systems for re-use; it should also make a significant contributions to a deeper theoretical understanding of the nature of computer based learning environments.

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'ORIENTATION MODULE' TO INCREASE EASE OF ACCESS TO ONLINE DISCUSSION FORUM FOR POSTGRADUATE STUDENTS

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Abstract

Evidence from evaluation studies indicated that ensuring a smooth start to the semester would enhance the experience of online learning for both students and staff. The development and evaluation of an 'Orientation Module', that combined technical and social purposes, is reflected on here. The module was found to significantly increase the ease with which students accessed their online learning environment.

Keywords

online education, orientation, transition, innovation

Introduction

The importance of regular, personalised interaction with other students and members of staff throughout the learning process, whether at a distance or in face-to-face teaching, is well-documented (Garrison, 1985; Laurillard, 1993). This is a concept with much support from the self-directed, life-long learning model of further education in adulthood (Evans & Nation, 1996; Laurillard, 1993). It is therefore important to ensure that students are familiar with the online learning environment and are able to participate in the discussion forum. This paper reflects on an evaluation of an introductory, student orientation module which was developed as part of a larger innovation. It was an exploratory project which aimed to increase student familiarity with a novel learning environment. Although the focus was the online discussion forum, the wider web-based resources of Monash University were included, as well as the various software functions.

Evaluation Identifies a Need

The Department of Marketing, in the Faculty of Business and Economics of Monash University, received substantial funds to develop an innovative Master of Marketing which is delivered flexibly and online across all campuses. Some students decide to learn via the Internet because attendance on-campus is difficult for them. In the Department of Marketing, they are often mature-age students who have middle management positions which demand long working hours and they study part-time to maintain relevance to their industry. All postgraduate distance education subjects are presented via WebCT. The numbers of students is lower in comparison to the on-campus intake (35 compared to 80).

Successive evaluations of this innovation have shown that, although many students are quite comfortable with online learning, there continue to be factors affecting use. One indicator of this is the participation on the discussion forum where some students dominate the postings and others lurk. The unevenness in participation was not due to any lack of enthusiasm on the students' part. Evaluation surveys showed that 85% of the students were satisfied or very satisfied with the learning materials available, the logic and coherence of the development of the subject and the contact they had with staff. Evaluation of the website returned even higher levels of satisfaction (95%). However, semi-structured interviews and open-ended responses on surveys suggested that students perceived some drawbacks with the online learning process. In addition students' expectations depended on their prior learning experience. Distance education students were often delighted with additional contact, while students who were used to face-to-face teaching described the same experience as lacking human contact (Brace-Govan & Clulow, 2000). In spite of their positive attitudes, and taking their expectations into account, some students still expressed concerns that focussed mainly on technological functioning and familiarity with the learning environment.

The additional effort required by students to understand the unfamiliar software meant that the students had a lot to assimilate in their first few weeks of study. Furthermore, as part-time postgraduates, they were often only enrolled in one subject which meant that they were only actively aware of one contact person at the University – their online teacher. The students unfamiliarity with the software, coupled with their unfamiliarity with Monash University, placed a significant burden on online staff because student difficulties with hardware or software usually resulted in them contacting their teaching staff member for technical advice. Sometimes this was within the staff member's experience although at other times it drew the staff member into a protracted intermediary role between student and IT support staff from the Faculty. In addition, the delay created by technological needs had a domino effect and created some social difficulties. The online learning group was no longer a coherent cohort as some students were behind in their studies and not socially 'in step' with the other students who started immediately. For a learning medium that relies on significant levels of student-to-student interaction in discussion forums, this is problematic.

Social awkwardness online is not restricted to students who have to deal with technological gliches. Online forums can be daunting and knowing how to present oneself in a learning forum is not necessarily obvious either to regular computer users or to novices who might be less comfortable with computers. Learning how to learn online begins with learning how to present oneself and what kinds of cues to look for in textual interaction.

Overall, technological or social issues, alone or combined, have the effect of making an uncomfortable start to the semester for some students and an undesirable increase in workload for staff. A step needed to be inserted to relieve the burden on both students and staff at the beginning of the semester, not only to encourage group formation, but also to commence effective teaching as soon as the semester started. These students had a need to be orientated to Monash University through the medium by which they learn. What was required was a short, focussed, separate, discussion forum directed at all newly enrolled off-campus students. Experienced staff who could guide students through the technological issues and facilitate appropriate interaction would moderate this forum. The 'Orientation Module' was a modification within a larger innovation, designed to make the path smoother for both students and teachers.

Development of an Orientation Module

The 'Orientation Module' was developed using principles of moderation and group formation for online learning derived from Salmon (2000). The module addressed the first two stages of Salmon's five stage model. It is a peculiarity of the online environment that students need to set up (build) and navigate their learning environment where on-campus students might read maps to find buildings or lecture theatres. Therefore *Stage one* is completed when all technical links are successfully made and the first message from the student using the software (WebCT) is sent. The next crucial difference to on-campus learning is, that students usually have had some kind of face-to-face learning experience and so know, in a general sense at least, how to behave and socialise with other students and teachers. Even if they are uncertain of exactly what the social norms might be, on-campus students can always observe others until they feel comfortable. If online students only observe - nothing will happen. *Stage two* of Salmon's model identifies the process of initial socialisation. Although information exchange was included in the 'Orientation Module', this was to familiarise students with the software functions required for the online learning process, where Salmon's intention was that these later three stages are concerned with the processes of learning subject content. Focussing on these first two stages of Salmon's model a few short, but pertinent, exercises were devised along with commentary from the moderator that would direct the students to engage with WebCT and discover some shortcuts and useful protocols. Although the purposes of the activities in the 'Orientation Module' were either technological or social, in practice the activities aimed to combine both aspects as far as possible. The technological purposes were to successfully establish technological links between the student's system and the university, give an introduction to the functions in the software WebCT and, assist students in using WebCT effectively through hints and tips. The social purposes were to facilitate students' social interaction with each other (and staff) by modelling appropriate language and textual formatting and, offer students a forum in which to practise where it is clear that all the other participants are also inexperienced.

The 'Orientation Module' ran for three weeks with most activity during the on-campus orientation week itself as well as the week before and the week after. The asynchronous nature of the discussion forum offered flexibility and allowed students some leeway in the pace of their interaction. The moderator visited the forum frequently to ensure that students obtained relatively immediate contact. An important need for these students is to overcome feelings of isolation as well as to develop student-to-student communication. The 'Orientation Module' made use of the variety of University services available online to give a focal point for the interaction and simultaneously demonstrated the diversity of support for distance education students and gave them practice with WebCT functions.

Evaluation of an Orientation Module

During the third week of the 'Orientation Module' the semester began and students were able to join their online subjects. The 'Orientation Module' had been offered to all online students for Semester one, 2001, which included thirty-five students. Nineteen out of the thirty-five students, accepted the offer to participate and one group of twelve students from the 'Orientation Module' was tracked through the first four weeks of the semester. The expectation was that orientation students would be able to access their subject forum sooner than non-orientation students. The mean number of days to access the site for 'Orientation Module' students was 2.3 but the mean number of days for non-orientation students was 10.6 which substantiated the overall aim of the 'Orientation Module'. By day one of the semester, six of the orientation students had joined the conference and by the end of the first week there were ten involved. With the exception of one non-orientation student, fifteen did not get started with the subject forum for seven or more days. Of that fifteen, eight non-orientation students did not start for more than eleven days. The comparison demonstrates that the 'Orientation Module' had an impact on the amount of time it took students to join the subject discussion forum.

The other aim of the 'Orientation Module' was to facilitate socialising among students. The twelve orientation students represented a range of activity levels including: one that did not take part in the 'Orientation Module' in spite of being registered; another that did not join the subject forum despite being active in the 'Orientation Module' and; one that was relatively inactive on the subject forum but quite active on the Orientation forum. Of the remaining nine students, various levels of activity in the orientation and subject forums is evident but, the majority, six students, are consistently active. Five students maintained levels of readings and posting fairly similar to each other giving the impression of a dialogue in the subject forum. The suggestion here is that the other principle aim of the 'Orientation Module', to facilitate social and learning activity, has been successful and analysis of the discussion forum could confirm this suggestion. This has not been addressed as ethics permission has not been received.

However, other evidence from the mock assignments that students posted in the 'Orientation Module' tentatively support their engagement with the wider University. To practise the assignment function, students were asked to visit the Monash Postgraduate Association and then submit a short report. The reports suggest that the students found the site fun and full of unexpected information and research links. Comments suggested that they would make use of this facility. Further positive feedback came from the evaluation survey at the end of the module.

Conclusion

Overall, the students that took part in the 'Orientation Module' did access the subject site more easily than those who did not complete the 'Orientation Module'. Their activity patterns suggest that they are engaged with the subject and were possibly working together. Their commentary, from different sources, suggests that they found the process useful and that it made them aware of the wider university. This is positive support for this modification to an innovation, confirming the direction taken after evaluation of the larger endeavour. Further analysis of the discussion forum could provide evidence that could be useful. It would also be helpful to interview staff to discover how they perceived the exercise and to extend the data with further reviews of the 'Orientation Module' from the start of other semesters. In spite of these shortcomings, the project was considered to be successful. A future development of the project would be to offer all students an introduction to learning how to learn online. Given sufficient resources, in particular specifically assigned IT and teaching staff, this kind of orientation process could introduce students to their learning environment in one week. By focussing on removing firewalls, obtaining passwords and access to libraries organised, as well as facilitating familiarity with the software and internet resources in a concentrated period of time, the experience of learning online would be enhanced for both students and staff.

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AN@TOMEDIA™
A NEW APPROACH TO MEDICAL EDUCATION DEVELOPMENTS IN ANATOMY

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Abstract

An@tomedia™ is an intuitive, interactive, self-paced learning program of anatomy on CD-ROM. It provides multiple perspectives for the nine modules of the human body (back, abdomen, thorax, general anatomy, upper limb, lower limb, pelvis, neck, head) each of which is independent and of equal importance. 'Dissection' incorporates practical (including emergency) procedures and postmortem images, 'Imaging' incorporates sectional and endoscopic anatomy, 'Regions' incorporates surface and functional anatomy, 'Systems' incorporates conceptual and clinical anatomy. The program features creative visuals with graphic overlays, diagrams and explanations which provide a simpler conceptualisation of the complex reality. The user can choose the order and rate in which they study the body, their direction of learning about it (by construction or by deconstruction) and the degree of detail (with optional text, overlays and 'rollover' identifications at every screen). An@tomedia™ is a valuable resource for all medical and allied health professionals, allowing anatomy revision with a clinical and applied emphasis. Alternatively, users may simultaneously upgrade their own understanding while engaging in patient education. An@tomedia™ may also be utilised to help patients learn about the anatomical basis of a relevant clinical procedure (eg. arthroscopy) or surgery (eg. laminectomy) that may be required or have occurred.

Keywords

anatomy, imaging, dissection, regions, systems

Anatomy is the core subject underpinning medicine and health related sciences. It describes the normal structure of the human body and forms a springboard for the later study of abnormality. Dissection is ideally the most valuable means of gaining an understanding of anatomy. However, it is difficult technically, logistically complex, time consuming and expensive. In currently crowded health sciences curricula (and with the increasing development of new subjects and integrated systems/problem-based curricula) these issues are coupled with less time to make sense of anatomical knowledge or (more importantly) integrate such knowledge in a clinical context. Practitioners are faced with different learning challenges. They frequently need to 'brush up' on their anatomical knowledge within a clinical or applied context, where time constraints require fast and easy access to information. Both features are rarely found in current textbooks of anatomy.

AN@TOMEDIA ™ is an attempt to redress some of the above problems. It is being completed in the context of a new practical anatomy teaching program developed at the University of Melbourne in response to feedback from students urging the construction of a guided dissection, on computer, that can be used interactively. A text, compatible with this program, has already been designed and piloted.

There are already many types of learning materials in anatomy. Computer tutorials (eg. Anatomy Project', 'Slice of Life'), point and click browsing systems (eg. 'ADAM', 'Integrated Medical Curriculum', 'Bodyworks'), electronic reference atlases (eg. 'Elsevier's', 'Netter' and 'McMinn'), data bases (eg. Glaxo Virtual Anatomy') and videos of dissection (eg. Clemente, Ackland) are all of use, but have the limitation of not being interactive in all aspects of learning. This interactive multimedia CD-ROM contains dissections of the entire body (including over 2000 individual anatomical images), together with full interactive text and graphics.

AN@TOMEDIA ™ encompasses nine modules, each of which is independent and of equal importance. The modules are (1) Back, (2) Abdomen, (3) Thorax, (4) General Anatomy, (5) Upper Limb, (6) Lower Limb, (7) Pelvis (8) Neck, (9) Head. Multiple perspectives are provided for each of the nine modules: *'Dissection'* includes practical (including emergency) procedures and postmortem images, *'Imaging'* incorporates sectional and endoscopic anatomy, *'Regions'* incorporates surface and functional anatomy, *'Systems'* incorporates conceptual and clinical anatomy.

AN@TOMEDIA ™ is unique in that it uses real human bodies (prepared and photographed in each stage of dissection, layer by layer from skin to bone) complimented by sections, imaging and procedures that enable the user to both construct and deconstruct the human body *interactively*. Creative visuals with graphic overlays, diagrams and explanations provide a simpler conceptualisation of the complex reality. The program also highlights the comparative appearance of 'fresh', un-embalmed dissections.

Operators can choose the order and rate in which they study the body, their direction of learning about it (by construction, via systems and regions or by deconstruction, via dissection and imaging) and the degree of detail (with optional text, overlays and 'rollover' identifications at every screen). The specially designed protocol enables them to 'build' systems, 'assemble' regions, 'trace' radiological images, 'map' surface landmarks and 'discover' underlying anatomical concepts, all on computer. They can alter their approach at any time and view the same anatomical structure from a different perspective (eg. a lumbar puncture followed by an x-ray of the spine then a dissection series).

The intended learning outcome is that by using *AN@TOMEDIA* ™ the viewer will be able to identify and interpret the normal structure of the human body. Specifically:

- the subdivision of the human body into regions and the organisation of structures which contribute to a common function into systems (correlating structure with function)
- the anatomical structures exposed by dissection and observed, palpated or pierced in practical (including emergency) procedures
- the surface markings and applications of clinically important structures
- the appearance of the human body in section at important planes and of normal structures in radiological images
- the differences in appearance of post-mortem (un-embalmed) images in contrast to embalmed specimens.

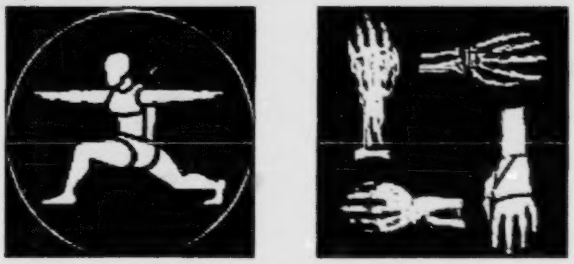

Figure 1: Menu screens showing module and perspective selection for AN@TOMEDIA ™

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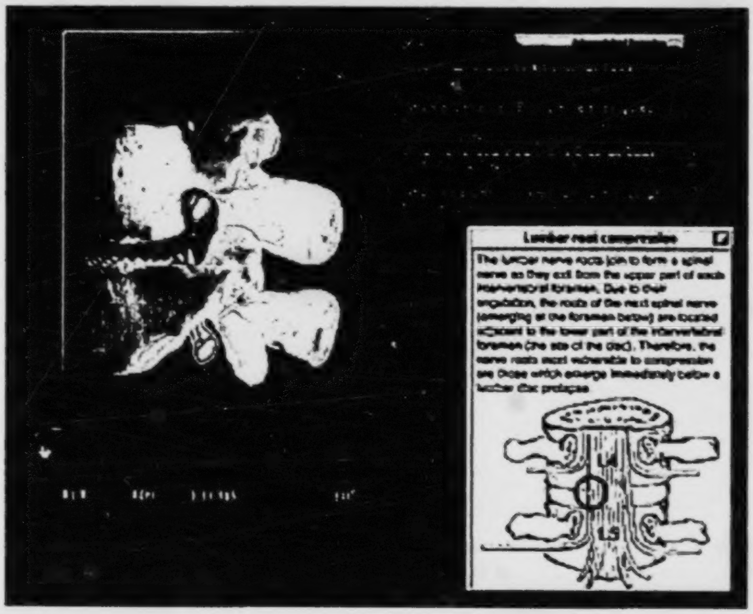

Lumbar root compression

The lumbar nerve roots join to form a spinal nerve as they exit from the upper part of each intervertebral foramen. Due to their angulation, the roots of the next spinal nerve (emerging at the foramen below) are located adjacent to the lower part of the intervertebral foramen (the site of the disc). Therefore, the nerve roots most vulnerable to compression are those which emerge immediately below a lumbar disc prolapse

Figure 2: Sample screen from AN@TOMEDIA ™

AN@TOMEDIA ™ is also a valuable resource for the practitioners, allowing anatomy revision with a clinical and applied emphasis, as well as the option to explore the program choosing their own rate, order and level of learning. Alternatively, the clinician may simultaneously upgrade their own understanding while engaging in patient education (eg. accessing relevant information from the CD-ROM with the patient). *AN@TOMEDIA* ™ may also be utilised to help patients learn about the anatomical basis of a clinical procedure (eg. arthroscopy) or surgery (eg. laminectomy) that may be required or have occurred.

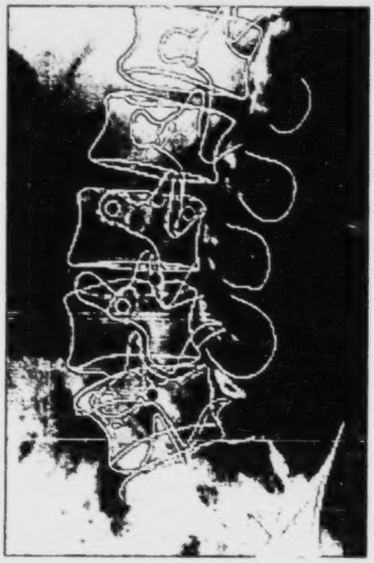

Figure 3: Sample radiograph showing rollover 'hotspots'

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Assessment

AN@TOMEDIA ™ has the capacity to profoundly affect assessment (both formative and summative). Integrated into the design of the program are questions relating to the anatomical basis of clinical phenomena. For example, the viewer may interpret an image of a dissection of the back displaying the typical site where a bulging intervertebral disc may compress the roots of a particular lumbar spinal nerve. A range of related questions could be posed to interpret the clinical symptoms and signs and relate them to the specific lesion displayed. This is the basis of future collateral programs interpreting the program into the clinical setting.

Evaluation

Two comprehensive (both quantitative and qualitative) evaluations have been completed. The first by 132 first year medical students at the University of Melbourne and the second by eight external evaluators (including content experts in anatomy, surgery and education from Australia and overseas). The results of both evaluations have been overwhelming positive (Kennedy, Eizenberg & Kennedy, 2000) and these will be discussed.

The first two modules ('Back' and 'Abdomen') are completed and are commercially available. Eventually, the content for each module may be available for distribution on a single CD-ROM, alternatively all nine modules may be purchased on one CD-ROM. Practitioners will also be able to choose combinations of modules, such as 'The Back, Upper Limb and Lower Limb' for those primarily interested in the musculoskeletal system. The forthcoming two modules Thorax and General Anatomy will be demonstrated.

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ENCOURAGING ACTIVE LEARNING WITH MORE INTERACTIVE WWW DESIGNS

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Abstract

When faced with the challenge of developing an undergraduate mining subject – Process Simulation and Control - in flexible mode to allow students on location at various remote mine sites to study the subject simultaneously with their campus-based colleagues, the development team was keen to focus on providing a quality learning experience as opposed to just delivering content remotely. The challenge lay in how to harness the new technologies in ways that would support and improve learning, not just replace a traditional form of delivery (lecturing) with its digital equivalent (lecture notes online). This paper uses Oliver, Omari and Ring's (1998) WWW use framework to outline and categorise the uses of the WWW in this subject in terms of fostering learning.

Keywords

online learning design, technology for learning, collaborative learning

Introduction

In 2000, The University of Queensland's Department of Mining, Minerals and Materials Engineering launched the Undergraduate Site Learning Program (USLP), which is a new teaching and learning initiative focused on providing a structured learning environment for senior undergraduate students who are selected for placement at mine sites more than 1000km from the main University campus in Brisbane.

The emphasis of the USLP is on integrating work practice and flexible learning. Students complete useful tasks for the minesite while concurrently fulfilling university course requirements via access to flexible learning resources. This paper describes the first course to be developed and delivered entirely in flexible mode - *Process Simulation and Control*. Only a few students were studying this course remotely from the mine sites and the majority of students taking this subject were campus-based. *Process Simulation and Control* introduces students to mathematical modeling techniques and then teaches them to apply these to practical tasks. Students are taught the theory and practice of basic automatic process control, and are given exercises modeled on tasks typically undertaken by a process control engineer in a minerals processing plant.

In designing this course, we wanted to use the new technologies in ways that would support and improve learning, not just replace a traditional transmission form of delivery with its digital equivalent. Oliver, Omari and Ring (1998) provide a framework for considering the various forms of educational applications the world-wide web supports to foster learning. Their web use framework is categorised by four main web applications for teaching and learning: a) Information access, b) Interactive learning, c) Networked communication and d) Information construction. This paper considers the extent to which each of these categories of WWW use is evident in *Process Simulation and Control* and the pedagogical decision making that shaped the final design.

Information Access

It has long been argued in the literature that predominantly transmission focussed approaches are less likely to lead to positive learning outcomes and deep learning (Laurillard, 1993; Oliver, 1998; Biggs, 1999), and ironically the advent of the WWW has unfortunately provided the technological means of fostering just such an approach (Brown, 1997; Wardrop, 2000). A scan of online offerings from the higher education sector will reveal uses of the web predominantly for delivery of content and information.

The WWW as a medium of delivery of complex and lengthy textual material can be especially counter productive (Carr-Chellman & Duchastel, 2000) particularly when students are studying at remote locations where issues of bandwith, cost of connection and download speed can negatively impact on their access to this information. Students also tend to print out any content that is provided online, and this can result in content being delivered in a confusing disarray of single disconnected sheets. Simply publishing lecture notes online or a great deal of printed material online, does nothing to enhance the pedagogy (Oliver, 1998). Oliver et al. (1998) and Salmon (2000) argue that while access to content is necessary it is not a complete component of learning and that more interactive uses of the WWW will contribute to improved learning outcomes. The WWW needs to be used in much more interactive ways if it is to serve as a useful tool for learning.

The WWW was used minimally in *Process Simulation and Control* in terms of information access. It did however provide links to useful resources together with access to case study material related to a minerals processing engineering problem. This material was presented online so that it could be supported by the network features of the site and would dovetail with the online group work components. Students were able to access all of the relevant resource material related to the case study from the website which they used to collaboratively solve the engineering problem.

Interactive Learning

The design of this subject places the learner at the core of the teaching and learning experience, and like Sims (1999) and Biggs (1999), emphasises the importance of learner activity and interaction as essential mechanisms to support learning. They argue that students are less likely to learn in deep ways by passively receiving information transmitted to them no matter how technologically rich the delivery mechanism might be. Deep learning is more likely to occur when students are required to actively engage with that information - to structure it and build links from it to their exisiting knowledge framework - to undergo conceptual change.

The WebCT site for *Process Simulation and Control* focuses primarily on increasing opportunities for interaction and self-assessment rather than delivering content. In this site, students were provided with a number of downloadable process control loop simulators that were designed to encourage students to apply their understanding of 'practical control' to realistic scenarios by manipulating variables and checking outcomes. The WebCT quiz tool was also used in a variety of ways to provide students with interactive exercises that allowed them to gauge their growing understanding of concepts and which also provided the course coordinator with data about student progress. In addition, a set of 'test yourself' review questions was included on the site which also provided detailed, immediate feedback for students to check their understanding. Each topic had ten review questions for self-assessment purposes.

There is much focus on active learning in this subject, and in a flexible learning environment, it is particularly important for teachers and course designers to ensure that adequate feedback mechanisms are in place for learners to gauge their progress during the course (Boud, 1995), and to provide access to help where required.

Networked Communication

Biggs (1999) argues that when students are given opportunities to engage in dialogue about their growing understanding of new material and to receive feedback that can extend this understanding, they are more likely to engage in higher levels of cognitive activity and thus achieve deeper levels of learning. The WWW supports many different forms of communication that can be used to provide opportunity for this collaborative form of learning. Many communicative activities were designed in *Process Simulation and Control* to encourage students to negotiate meaning and engage in purposeful and collaborative discussion and activity. These included the development of email study groups where students formed groups and each group had its own discussion list forum to encourage interaction and collaboration within a manageable, supportive setting. An additional general bulletin board forum was created to keep the site dynamic by allowing new information and communication to be added during the course.

The Networked Communication facilities of the subject enabled the activities and tasks flagged in other resources to be drawn together. Students had the opportunity to test their understanding of mathematical model theory via the learning guide, the practical control exercises and the review questions on the WebCT site. The course coordinator was able to monitor students' progress by reviewing their responses to tutorial questions and discussion topics posted on the bulletin board, and track their attempts at the review questions. The remote USLP students were encouraged to use the bulletin board to contact their classmates on-campus and describe some of their experiences at the mine site. Their classmates were encouraged to reply, and a dialogue was created. Thus the networked communication features of the package played an important role in creating a convergent learning environment across two very different physical settings.

Information Construction

The WWW can be used to support the construction of information and knowledge, where documents can be created and modified after interaction and collaboration. In *Process Simulation and Control* students were provided with a case study where they were required to solve a minerals processing engineering problem. They were encouraged to take on the role of consultant engineer applying the concepts covered in the course to a real problem likely to be encountered in the workplace. The case study material is on the WebCT site, and provides background information, flowsheets, data sets and other information for students to tackle the simulation and control problems. This material is presented in the same way that a real consultant would expect to receive material needed for a study, in a variety of separate documents and notes. Just as in the workplace, students are encouraged to work with others to solve the problem and to make recommendations about optimising processes. The communication facilities of the WebCT site encourage students to work together in this way. A large portion of the assessment for the subject is based on submissions relating to the case study.

In addition to the case study activity students were also provided with opportunities to collaborate and construct information in the following ways:

- The development of a set of Frequently Asked Questions (FAQs) which was added to over the semester. Students with questions were encouraged to post them to the bulletin board and other students were encouraged to answer them. The 'best' student answer was then uploaded to become an 'official FAQ and answer'.

- A dynamic glossary built over the duration of the course, with students being encouraged to add definitions in a similar process as the FAQs.

- A 'bug fix' facility where students were encouraged to identify and pose solutions for any bugs that appeared in the simulation software.

- Short answer questions on the major topics were presented in private bulletin board fora for students to work in groups and answer. Groups shared their findings in the public forum.

- Groups collaborated to answer review questions.

Conclusion

The WebCT site is the dynamic learning hub of the course, and the WWW is used for communication, interaction, information exchange and knowledge construction. Students in this subject do not work as isolated remote individuals steadily working their way through the materials, but as groups of learners connected through time and space via the use of the communication facilities of the WWW. The communication tools are used in this subject to provide extended access to fellow learners and to teachers, and they have the potential to connect with relevant people outside of the immediate learning environment.

In contrast to a content focussed online delivery approach, this approach is learner-centred with an emphasis on educational design that values learner interaction, interactive learning, problem solving and networked small group work with a focus on realistic contexts. The subject offers students an opportunity to solve real process control problems in ways that mirror the work of professionals in the mining environment: through a course design which emphasises interactive learning and networked communication over information access.

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DEVELOPING A WEB BASED METHODOLOGY TO TEACH A WEB-BASED TECHNOLOGY – THE E-JOURNAL APPROACH

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Abstract

This paper outlines the development of a web-based teaching methodology, the E-Journal, which aimed to assist students in the better integration of theory and technical skill development for the creation of virtual worlds within design and engineering disciplines. The paper outlines the development of the E-Journal, its implementation within a teaching unit and evaluates its benefits from both a student and teacher perspective and recommends future applications of the approach.

Keywords

journal, virtual worlds, design, engineering, activity theory, problem-based learning, constructivist learning environments, flexibility

Introduction

The teaching of computer-based technologies to Design and Engineering disciplines within a higher education environment is commonplace. Students are often required to undertake foundation computer classes that focus primarily on skill development and then are generally required to apply these skills later within their course to specific design and engineering projects. Personal experience of the authors has shown that such an approach is useful in the teaching of a particular technology but limited in the creative exploration of the technology within the discipline. However, new information technologies offer the potential to allow teachers to explore new ways of teaching their subject giving individual attention to the learning needs of students (Baillie, 2000). This learner-centred approach focuses on a "problem centred, activity-based approach where the computer applications are anchored in authentic and familiar contexts in which teaching and learning occurs" (Hill, 1999, p. 261). This paper presents one approach to the creation of a learner-centred teaching environment using new information technologies. The development of the E-Journal and its implementation within a teaching unit will be discussed to demonstrate how such a methodology can be used to assist students in the better integration of theory and technical skill development.

Background

The term Synthetic Environment refers to an interactive computer generated 3-Dimensional multi-discipline representation of an existing environment or conceptual design. This emerging field of study has significant potential to Design and Engineering disciplines as the technology allows for enhanced communication to a multi-layered audience (Bucolo, 2001). Typically a virtual world (VRML 2.0 model) is developed with input from a number of Built Environment disciplines. The representation allows a range of professional groups the opportunity to contextually evaluate the design concept. This collaborative construction and evaluation paradigm shift in Design and Engineering has necessitated a corresponding change in Design and Engineering education.

In 1999 the Faculty of Built Environment and Engineering established an advanced computer visualisation facility – the Synthetic Environment Laboratory (online), which allows students and staff to explore the impacts and application of this technology from multiple perspectives. To use the facility students are recommended to enrol in the Faculty based elective – Fundamentals of Synthetic Environments.

The unit, Fundamentals of Synthetic Environments was offered initially in Semester 2, 1999. The unit provided an overview of Synthetic Environments focusing on its application to Design and Engineering disciplines as a tool for enhanced communication within a design process. The theory component provided an overview of historical and contemporary issues related to Synthetic Environments, whereas the tutorials provide the necessary skills for the creation of virtual worlds.

The teaching approach adopted followed the traditional paradigm of providing weekly theory lectures in a face-to-face mode followed by separate tutorials focused primarily on skill development related to the creation of virtual worlds.

Unit Development

A Small Teaching and Learning Development Grant was awarded in late 1999 with the aim of improving the delivery of this unit. The main aim of this grant was the development of a web-based environment for the enhancement of the unit. It would need to continue to cater for disparate levels of technology literacy through the use of self-paced tutorials whilst encouraging group learning through weekly presentations and reflections, and then integrating theory and skill in such a way that students and staff would perceive and relate to the desired synergy.

A further aim was to allow staff that may not necessarily have the skills and knowledge of this technology to view the lecture content and monitor student development to assist them in the integration of this technology into future units. By modelling the approach and actively engaging faculty members in it as 'expert contributors' to the E-journal, it was intended that staff may gather both experience in and ideas for utilising this instructional method. Collis and Moonen (2001) posit with regard to technology innovations, "the instructor is more likely to proceed if he or she is convinced of the effectiveness and pay-off of the change" (p. 61). After considerable analysis of the benefits of the existing mode of delivery, it was decided to proceed with the development of a web resource, which used the metaphor of a technology journal.

E-Journal Approach

The unit was re-organised into six discrete 'online journal editions' which covered both the theory and skill development. Within each edition, which were uploaded throughout the semester on a fortnightly basis, the following was included:

- Feature Article (Lecture content presented both as a web summary and an expanded PDF document)
- Letter to the Editor (a re-worked discussion list in which students were required to comment on a particular issue of the feature article)
- Online tutorial (traditional tutorial content provided online with additional face-to-face tutorials being provided every alternative week)
- Online Case Study (which the students developed in groups and presented as part of the journal).

No face-to-face lectures were provided, however a face-to-face tutorial was provided every alternative week to allow students to ask specific questions not easily communicated through a text-based medium.

Teaching Innovations

The E-Journal allowed staff to present information to students in a stimulating manner, which accommodated for flexibility in time and place of delivery and allowed for self-paced understanding of concepts related to Synthetic Environments. The challenge was to develop a Constructivist Learning Environment (CLE) to support an activity centred approach as described by Jonassen and Rohrer-Murphy (1999), which led the team to include a number of elements in the design.

The Publishing Paradigm

Within each edition, a feature article was presented as a generic concept. Students had the option to view a summary of the article and if required could gain a greater understanding through downloading the complete article as a PDF file. Additional investigation by the student on a particular topic was made possible through the inclusion of embedded links within the PDF. In any case students were required to reflect upon the topic within the context of their own discipline. This was facilitated by providing students with a controversial statement at the end of each article which they were required to respond to using a discussion list in the form of a letter to the editor.

Discipline Application

Students were encouraged to apply the knowledge gained within this unit to concurrent design and engineering projects within other units or within their workplace. This immediate transfer of knowledge assisted in student motivation and creative investigation of the technology.

Group Learning

Students were required to present all development work as a case study continuously throughout the semester. As these projects consisted of both discipline specific and multi-disciplined projects, varying approaches to the application of the technology was available for the students to view and possibly apply to their own projects. In essence the students were developing a series of help files for other students to view. A separate discussion list was maintained for tutorial and case study discussion.

Staff/Student Reflections

Since the unit was initially offered in Semester 2, 1999 approximately 120 Design and Engineering undergraduate students have undertaken the redeveloped unit as part of their electives studies program. The strategy used to monitor and evaluate student-learning outcomes included the assessment of learning outcomes as compared with the original unit, together with formal student evaluations of the unit (an 18-item questionnaire administered by the Teaching and Learning Development Unit). An analysis of grade distribution found that there was no significant difference between student submissions related to the use of the web based resource to that of traditional lecture/tutorial delivery offered in Semester 2, 1999. Further, formal student evaluations of the E-Journal approach were extremely encouraging. Formal student feedback indicated that the use of a directed student discussion (in the form of letters to the editor) was well received by the student cohort. However what came as a surprise was the student dislike for online tutorials preferring the face-to-face approach. It was difficult to determine student interest in the unit. Work was continually being submitted, however this did not indicate student motivation, which can be quickly determined through traditional lectures.

Teaching staff evaluation of the approach was also encouraging. It was found that the unit was useful for the integration of theory and application. The mechanism of knowledge construction through social negotiation in a constructivist learning environment (Jonassen, 1994) was evidenced through an increase in student discussion and cross-linking of discipline specific topics. This encouraged group learning within a multidisciplinary context. The letters to the editors approach required students to make a connection between the theory and skill being presented within the fortnightly editions.

The development of each E-Journal however was time consuming. Re-working lecture content into a print/graphical format to ensure that it is both stimulating and challenging to the students requires considerable effort (however if done correctly is worth the effort).

Future Development

A QUT, Faculty Teaching Innovation Grant has been awarded to continue the development of this project. Specific improvements include improving the 'look and feel' of the site, allowing further integration of the case studies and discussion lists. It is envisaged that each E-journal edition will be identifiable as a separate entity. The use of block mode teaching rather than online tutorials will also be considered. Finally once developed this methodology will be evaluated across a range of subject areas with the Faculty.

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WHY USE THE ONLINE ENVIRONMENT WITH FACE-TO-FACE STUDENTS? INSIGHTS FROM EARLY ADOPTERS

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Abstract

This study illustrates the convergence of two teaching and learning media, face-to-face and online, as reflective lecturers seek to address the limitations of a single medium. Innovative university lecturers were interviewed about their use of online environments with face-to-face students. The interview data revealed a set of problems in the traditional face-to-face situation for which the lecturers sought solutions using the online environment. Three types of problems were identified: a need to improve the access to essential unit information; to increase the amount and quality of student interaction; and to increase student autonomy.

The lecturers identified and implemented three strategies for solving these problems. These included using the web to:

- *Disseminate and collect information and materials;*
- *Mediate student-student interactions; and*
- *Mediate student learning.*

Whilst the first strategy was successful in increasing access to essential unit information, the second strategy did not necessarily increase the amount or quality of student interaction. It appears that interactivity is dependent on the nature of the learning activity undertaken and lecturers' competencies in facilitating online learning, independent of the medium in which the task is set. The success of the third strategy involved the redevelopment of a traditional lecturer-dependent course to embrace more student-centred approaches.

Keywords

mixed mode, online learning, student-centred teaching, self-directed learning, online supplementation

Introduction

The World Wide Web (WWW) challenges traditional campus-based education to be more flexible and innovative in its delivery. Content and activities can be placed on the WWW for students both as a supplement to lectures and as a replacement of them. In addition, students can independently search the WWW to access relevant content as well as use it to communicate with each other and the lecturer. All this can be accomplished off-campus and at a time that is convenient for the student.

Much of the literature reports on the use of online environments with geographically dispersed students (for example Berge & Collins, 1996; Kearsley, 2000; Palloff & Pratt, 1999). This use offers obvious communication advantages over traditional distance learning modes. But lecturers are increasingly using the WWW with students who have elected to come on-campus to study (Palloff & Pratt, 2001), indicating that its use may also enhance face-to-face teaching.

How does use of the WWW alleviate some of the problems university lecturers perceive in typical face-to-face teaching? This question was explored by interviewing innovators and early adopters about their use of online environments with face-to-face students and by examining the web materials, including the online tasks, associated with each unit.

Methodology

Semi-structured interviews were conducted by both authors with five university lecturers from the Business Faculty of a large Western Australian University. These lecturers were identified by their colleagues as innovative leaders and reflective practitioners in teaching and in using online environments. Typically, these lecturers had been teaching 'on-campus' face-to-face units consisting of a one-hour lecture and a two-hour lab or workshop weekly over a 14-week semester. Several of the lecturers also taught in offshore programmes where their unit was delivered in one or two short intensive blocks of face-to-face teaching.

Of the five lecturers interviewed, four were from the same curriculum area: information systems. This is an area where the web is a significant medium. The lecturers were very knowledgeable about the web and confident to explore the use of the online environment as a vehicle for their teaching. Between the five lecturers, there were eleven units in which they supplemented their face-to-face teaching with online components. Three of these were at postgraduate level.

Through a series of open-ended questions detailed in Table 1, these lecturers were encouraged to discuss their decisions relating to the use of the online environment with face-to-face students and their subsequent experiences of teaching the unit/s using the online components. In addition, the associated web materials, online tasks and web-based student interactions for each unit referred to the interviews were examined.

1. What is the online component of your unit?
2. What other resources do your students have?
3. What do you want your students to get from the online component?
4. What feedback have you had from students?
5. What do you feel has been the value of online?
6. How have the online components impacted on the depth of learning?

Table 1: The key interview questions

During the interviews, which lasted for approximately one hour, both authors took notes and used reflective listening techniques to check their interview notes during the interview process. These notes were compared after the interview, combined into one interview report and then checked for accuracy with the interviewee. The final agreed interview report was then used for the analysis. The online components discussed in the interview were examined both during the interview with the lecturer and were revisited afterwards for further observation and analysis.

The data from the interview were considered in relation to the associated online components. Data analysis was conducted through the comparison of the intended function of the online components with each lecturer's perceptions of the final outcomes.

Findings and Discussion

As O'Donnell (cited in Edwards & Fritz, 1997), notes " the best way to view information technology is to let it address the problems we already have" (p. 3) and this certainly happened with these innovators. Through question three, the interview data revealed a set of problems in the traditional face-to-face situation for which these lecturers sought solutions using the online environment. Analysis of the problems revealed three types. The first type of problem was categorised by a need to improve the access to essential unit information. The second type was categorised by a need to increase the amount and quality of student interaction in a unit. The third type of problem was categorised by a need to increase student autonomy. Did the addition of online components serve the function intended by the lecturers?

The Need to Improve Access to Essential Unit Information

The first category of problems was characterised by a need to increase student access to materials and information held by the lecturer. This included essential unit information such as unit outlines and assessment details; lecturer contact details and availability; late-breaking news; application software; lecture slides; learning guides; and answers to common student questions. In addition, lecturers sought to get information back from students in a manageable format. The impact of these problems was magnified with offshore students. To address these problems, the web was used to disseminate and collect information.

Lecturers found that publishing unit information and materials normally disseminated in face-to-face sessions reduced the number of individual enquiries for these materials. For example, late enrolling students were able to access essential unit information and students who had missed lecturers and workshops were able to access notes and handouts from the relevant sessions. Publishing the lecturer slides was additionally beneficial as students used them as guides for further study, as sources of examples, and as guides to the key points for revision. The use of the web in this adjunct mode provided the students with an alternative way of accessing information presented in the face-to-face mode. Edwards and Fritz (1997) have noted correlations between access to material and student perceptions of independent learning and mastery. Providing increased access to materials is one way to enhance the effectiveness of the teaching.

Much time in face-to-face sessions is taken up with course administration involving he collection and dissemination of information. By using the web to make application software available for download instead of distributing the software in the first workshops, as previously was the case, workshop time was reclaimed for learning tasks. Another lecturer reclaimed valuable face-to-face time by using online forms to collect unit management data such as the membership of collaborative groups and unit evaluations. In addition, students were able to submit and share with the whole class relevant annotated web links.

The web was also used successfully to update information for students. Both email and discussion boards were used to give the students increased access to the lecturer and to each other. Common or trivial questions were answered through separate 'frequently asked questions' (FAQs) boards to which students were also encouraged to post their questions. This resulted in two advantages to the lecturer: often another student answered the question before the lecturer got to see it, and because of the public nature of the posting of the question and answer, the number of emails asking the same question was reduced.

All the lecturers reported that their online materials made the preparation, management and delivery of their face-to-face teaching much more efficient. Further, by providing appropriate resources on the web site, lecturers were able to direct offshore students to prepare for intensive blocks of face-to-face teaching. Similarly, students and lecturer could stay in touch after the teaching block was completed through to completion of the unit. In addition, lecturers were able to selectively access the resources on the web site for supplementary purposes as necessary.

These findings suggest that the web can provide solutions to problems in face-to-face teaching characterised by a need to improve access to essential information. In this way, it can aid in unit administration, particularly in units with large numbers of students. Does this advantage in the use of supplementary online components extend to improvement in the quality of student interaction?

Problems Concerning the Need to Increase the Amount and Quality of Student Interaction and Discussion in a Unit

Two specific student-student communication problems were identified in this study. For some lecturers, the nature of the labs and workshops did not allow for much student-student interaction and they hoped to increase the interaction by providing discussion boards for use outside of contact times. For others, the level of face-to-face discussion in the workshops was often not thoughtful enough and these lecturers realised, as Palloff and Pratt (1999) suggest, that use of asynchronous discussion may increase the reflection and thoughtfulness in student discussion.

On investigation, use of the discussion boards varied in quantity and quality. Where there was no specific task required in the discussion boards, very little use was made of them. Some boards showed a certain amount of student activity, but on closer inspection, it was not interactivity, defined by Laurillard (1993). According to Laurillard (1993), interaction requires an action by the learner, followed by feedback and then a response by the learner. Action alone is not interaction and is not characterised by the same thoughtfulness as interaction. Meaningful student discussion requires extended interactions on the same topic and is an important tool for developing higher order thinking skills (Berge & Collins, 1996). Rather than sustained interaction and discussion, much of the student activity on the discussion boards reflected single responses to simple tasks that required no more than the posting of information to the board.

Some lecturers realised that in order to sustain discussion online, they needed to design tasks requiring interaction and discussion. For example, in one unit where students were required to post a thoughtful piece of work and then respond to other students' questions and comments on it, more thoughtful interaction occurred. In another unit, discussion was extended and improved where students were required to comment critically and appropriately on a limited number of topics over a longer period of time or were required to work together in groups on collaborative tasks, as suggested by Palloff and Pratt (2001).

The exceptions to this were the boards set up for postgraduate students. These students used the boards independently of any tasks set by the lecturer. Both interaction and discussion were notably higher in these units, reflecting the fact that mature students are more likely to participate and be responsible for their own learning.

Importantly, a number of the lecturers commented on the need to know and be able to use specific online facilitation skills in order for successful discussion to occur. One lecturer felt that the amount and level of interaction could have been increased had he had more expertise in online teaching. Another felt that her skills in facilitating the discussion had been an important factor contributing to the success of the discussion.

Clearly a task requiring sustained interaction is only the beginning. Lecturers must establish and maintain an appropriate climate for the discussion and develop a feel for the shape of a discussion over time. They need to be able to weave together and to summarise the debate, to draw attention to contradiction or oversights at the appropriate points in time (Paloff & Pratt, 1999) and to provide the expert voice when necessary. It would appear that both lecturers and students need to learn how to communicate and facilitate communication in the new medium.

Much as has been identified by others (Berge & Collins, 1996; Palloff & Pratt, 2001), this analysis shows that the need for staff to learn new competencies is clearly an issue as online teaching increases. Some of these skills require an understanding of complex task construction appropriate to a tertiary environment. These skills are essentially the same irrespective of the mode of teaching. Other skills however, appear to be unique to teaching online (Goodyear, Salmon, Spector, Steeples, & Tickner, 2001, Gustafson & Gibbs, 2001,) such as the communication and facilitation skills described above.

Problems Concerning the Need to Increase Student Autonomy

The third type of problem addressed dissatisfaction with current face-to-face teaching methods.

For example, delivering content via weekly lecturers was not considered appropriate where students need to develop independent learning skills including responsibility for their own learning decisions. Teaching at university is characterised by lectures and tutorials where the lecturer is the "sage on the stage" and students are often passive recipients of wisdom. According to constructivist theories of learning, students learn better when they are active agents in the learning and the teacher shifts to become the "guide on the side". As Kearsley (2000) notes, student centredness is one of the themes shaping online teaching. A change to more student-centred approaches requires changes in the student role and often a re-conceptualisation of learning. An effective way to signal this change is to change the medium of the teaching and learning processes.

One lecturer used the web to act as an intermediary between himself and the students to facilitate more student-centred approaches. The web was used to mediate student-to-task, student-to-student and student-to-lecturer interactions. The lecturer replaced the face-to-face lecturers with a downloadable learning guide, freeing himself for more student-centred work involved in facilitating the online learning. He also provided a range of authentic tasks, such as case studies and problems, that required the students to locate and use web resources and to be more responsible for their own learning. In addition the tasks required and scaffolded higher order thinking skills. As facilitator, he directed students to each other for support and information. He met face-to-face with the group only three times in the semester and used the face-to-face meetings to negotiate and discuss with the students the shift to a more independent learning style. He met at the beginning to reassure the students and check that they had the requisite access to the online materials. He then met after about four or five weeks for a 'reality check', to reinforce the cumulative nature of the learning in the course, and to reflect on the students' experiences so far. His final meeting at the end was to debrief and capture some feedback for evaluation purposes.

He noted:

> The mismatch between students' expectation and the learning experience had to be dealt with. Students found it confronting in terms of time management and harder than face-to-face.

In utilising the online environment, this lecturer did not simply augment his face-to-face teaching, but changed the entire nature of the face-to-face component. The face-to-face discussions considered how the students should approach the learning tasks in the unit and the changing roles of students and teachers in more student-centred environments, as suggested by Forsyth (1998). Reflecting his changing role, the lecturer did not deal with content in these sessions, rather he helped the students negotiate how to approach the content and tasks available online. The lecturer indicated that generally the students were successful in this more independent mode of study and enjoyed the increased flexibility and choice in the way they studied this unit.

Conclusions

In this study, innovative, reflective lecturers used the web to alleviate three types of problems in face-to-face teaching: problems caused by a finite number of scheduled face-to-face sessions, problems associated with the amount and quality of face-to-face student interaction, and thirdly problems associated with student dependence on the lecturer. Their solutions through the use of the web met with mixed success.

It appears the web can be used to publish and to communicate administrative information successfully. The lecturer has increased confidence that all students have access to the information, and valuable time in face-to-face sessions is reclaimed for learning activity. Harasim, Hiltz, Teles, and Turoff, (1995) note that use of the web in this adjunct mode is the most common use of the web in higher education.

This study indicates that using the web to mediate student interaction will not necessarily increase the amount or quality of interaction. Learning is primarily dependent on the learning activity undertaken, and not the medium that the task is set in. A well-designed task that encourages thoughtful interaction is a prerequisite. That being said, however, for the best interaction to ensue, the lecturer needs to develop a new set of skills in facilitating discussion online to achieve the best out of the activity.

Finally, the web can be used to mediate between student and content and to support more student-centred approaches. When students access content via the web instead of the lecturer directly, lecturers can redirect their attention to supporting students' learning and deal with issues arising from the process of learning, thus helping students to become more independent learners.

In conclusion, the lecturers interviewed in this study used the web as a successful adjunct to face-to-face teaching to publish and disseminate information to students and to collect data from students. According to Palloff and Pratt (2001), use of the web in this manner is a good way for lecturers and students to enter the online environment. Whilst using the web to manage information in this way is relatively straightforward, this study suggests that use of the web to extend the opportunities for student-student interaction and student autonomy is dependent on lecturers' competencies in designing effective learning environments and tasks that will accomplish this. Moreover, whilst this is a necessary condition, it is not sufficient as lecturers also need to learn new skills in facilitating learning online.

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LEARNING ENVIRONMENTS OF THE FUTURE: NARROW TO BROADBAND VIA DVD

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Abstract

As the Web becomes part of mainstream learning and teaching at Australian universities, changes to online learning include a proliferation in the use of commercial learning environments and in the movement of institutional processes online. These changes indicate that now is an appropriate time to plan for the future. University of Wollongong has established a team to investigate learning technologies of the future. One of the first areas of concern for the group is the widening of the digital divide by broadband, creating the bandwidth rich and poor. A project is proposed to partially address this divide through the provision of media rich content by DVD in a hybrid DVD/WebCT environment.

Keywords
online learning, future technology, broadband, narrowband, DVD, DVD/Web hybrid

Introduction

Online learning has become part of life for most Australian universities. For many Australian institutions online learning has moved, or is moving, out of the aegis of early adopters and into the mainstream. Commercially available online learning packages are now the norm and as well as hosting content and facilitating interactions they provide some course management support. Institutional processes and resources, for example; eReadings, student surveys, enrolment procedures and other administrative tasks, in many institutions are moving online. These factors are changing learning web sites into eLearning portals or eUniversities. These are characteristics of what Taylor refers to as the "Fifth Generation of Distance Education".

> The fifth generation of distance education is essentially a derivation of the fourth generation, which aims to capitalize on the features of the Internet and the Web." (Taylor, J.C., 2001; p. 3).

Taylor's description of the generations of distance education is worth noting as it provides a concise encapsulation of the history of distance education and suggests that flexible and online leaning are later components of it. He describes the generations of distance education and their associated delivery technologies as:

First Generation - The Correspondence Model
- Print

Second Generation - The Multi-media Model
- Print
- Audiotape
- Videotape
- Computer-based learning (e.g. CML/CAL/IMM)
- Interactive video (disk and tape)

Third Generation - The Telelearning Model
- Audioteleconferencing
- Videoconferencing
- Audiographic Communication
- Broadcast TV/Radio and Audioteleconferencing

Fourth Generation - The Flexible Learning Model
- Interactive multimedia (IMM) online
- Internet based access to WWW resources
- Computer mediated communications

Fifth Generation - The Intelligent Flexible Learning Model
- Interactive multimedia (IMM) online
- Internet based access to WWW resources
- Computer mediated communication, using automated response systems
- Campus portal access to institutional processes and resources

(Taylor, J.C., 2001; p. 3).

As institutions and their online courses mature into Taylor's Fifth Generation the roles of instructional designers and educational developers need to change in response to changing needs of teachers. As a greater proportion of academics becomes skilled in developing online learning, instructional designers and educational developers can shift their focus away from training academic staff in the basics of online learning and towards providing finesse and increasing quality. As well they can plan for the future.

Another challenge to online learning is that the majority of students come to university with the expectations that IT will be part of, or even central to, their learning experience. As this expectation is obviously informed by students' prior experience of IT, it is probably safe to assume that the level and type of IT they expect to encounter will be media rich and highly interactive.

Further stress is placed on the role of online learning, as employers require the graduates they employ to have increasing levels of information and computer literacy. Universities need to maintain or enhance students computer and IT skills as well as enhance their online learning skills in preparation for a lifetime of learning.

As both students' expectations and employers' requirements change with new developments in software and hardware and as these changes are often fast and far-reaching it is safe to assume that most universities are hard pressed to keep up with them.

It is appropriate that the change in focus of instructional designers and educational developers comes as the changes mentioned above take place. As both changes impact on, and will alter the very nature of the student IT experience. To facilitate these changes to the student IT experience, University of Wollongong has established a small team:

- to investigate learning technologies of the future
- to assist in the planning of the future of online learning, and
- for the development of the student learning experience, especially their experience with IT.

Establishment of a Future Technologies Team

To facilitate the investigation of future learning technologies the Centre for Educational Development and Interactive Resources (CEDIR) at University of Wollongong has set up a team to investigate future learning technologies. With the working title of LOFT (Learning Online Future Technologies) the core of the team is made up of an academic, educational developer, a video producer, a multimedia programmer and when required draws upon the expertise of other staff such as:

- Technical staff at satellite campuses
- Intranet/network staff
- Other production and technical staff

The aims and objectives of the team are:

- To provide staff development opportunities in the use of current and future technologies in teaching and learning through the development of prototypal products
- To produce prototypes of learning/teaching materials that use digital technology and/or broadband Internet for both content provision and online collaboration (e.g. exemplar subjects that are beyond international benchmarks through their use of digital and broadband technology
- To provide advice on strategic planning for the implementation and adoption of these technologies
- To investigate the use of new technologies in teaching and learning
- To investigate the integration of new technologies with current

One of the specific issues LOFT is considering is the impact that broadband Internet will have (or is having) on online learning.

Broadband Internet

Broadband Internet is here. Telstra and others are advertising high speed Internet connections through, Cable modems, ASDL and satellite (see Table 1). The bold venture proposed by Teledesic (Teledesic, 2001) to launch 288 low orbit satellites for global, broadband, "Internet in the Sky" appears at first to be the work of a science fiction author. However, when one discovers who has invested in the company and their level of investment (see Table 2) it is clear that the IT business sector is clearly preparing for global, or at least widespread, broadband whether provided by Teledesic or others.

Method	Provider	Speed kbps down/up	Recurrent Cost per month	Set up Cost
PSTN modem	Telstra Bigpond	28.8	$24.95	
PSTN modem	Telstra Bigpond	56	$24.95	
ADSL	Telstra Bigpond	256/64	$78	$189 -$399
ADSL	Telstra Bigpond	512/128	$89	$189 -$399
satellite	Telstra Bigpond	64	$70.95	$430 - $1500
satellite	Telstra Bigpond	Up to 400	$92.95*	$430 - $1500
cable modem	Telstra Bigpond	256/64	$67	$189 -$399
cable modem	Telstra Bigpond	512/128	$72.55	$189 -$399
cable modem	Optus	(30 x)**	$69.95	$199 - $399
cable modem	Optus	(100x)**	$74.95	$598

*3GB download limit exists, 26.4 cents per extra MB
** Optus only provides approximate comparisons to 28.8kbps
PSTN = Public Switched Telephone Network

Table 1: Costs and speeds of broadband internet (data collected June 6, 2001)

Investor	Amount ($US millions)
Bill Gates	Undisclosed
Craig McCaw	Undisclosed
His Royal Highness Prince Alwaleed Bin Talal Bin Abdul Aziz Alsaud	200
Abu Dhabi Investment Company	121
The Boeing Company	100
Motorola	750

Table 2: Teledesic investors and amounts

From Table 1 it can be seen that for broadband, communication speeds are significantly higher and hence download times are much shorter. While costs are somewhat higher than for connections to PSTN (Public Switched Telephone Network) modems it is expected that they will fall in the not too distant future. Students with broadband connections to the Internet will be able to access media rich, interactive web sites and enjoy short download times. The files could consist of full screen, full motion video and high quality audio as well as text and still images. No longer will the majority of educational web sites be limited to text and still images or slim multimedia files like Flash.

When online learning is limited to narrowband, a digital divide is apparent between the access rich and the access poor. Students in the one online course could access the same material from networked computers in a range of locations and situations. It is possible that students with access to high speed Internet (such as T1 or LAN) at their place of work could enjoy fast downloads for little or no cost. Other students in the same class might access the material through a slow modem and pay an ISP for the service, while a third group with no personal access might be relegated to joining a queue at the campus computer lab.

It is quite possible that broadband could create another digital divide through creating a gulf between the bandwidth rich and poor. It is conceivable that some students may choose to use broadband while others, for reasons of affordability or access, might be constrained to a slow PSTN modem for access to their course.

One way to address, in part, the digital divide between the bandwidth rich and the bandwidth poor would be to supply students with access options for the course materials. Students with broadband could conveniently download media rich content from the institution's server while students with a narrowband connection could be supplied the media rich content via distributed media. The LOFT team considers that the relatively new medium of DVD has the potential to provide media rich content in a cost-effective manner and hence was worthy of further investigation and evaluation. To test the suitability of DVD to online learning it was decided to create an educational DVD. So that the DVD could be used as an integrated part of online learning it was decided that the prototype the DVD would be integrated with a WebCT subject.

DVD/Web Hybrid Project Description

The DVD/WebCT hybrid, will be an exemplar of one possible future scenario for online learning. As it was proposed to use the product primarily to demonstrate the technology for staff development purposes, a topic, relevant to the target audience was selected: Educational Videoconference Techniques.

The hybrid will provide information and training in several aspects of the educational videoconference, including:

- introductory information on aesthetics of video and the framed image
- on-screen communications
- manual style information on how to operate videoconference equipment
- examples of pedagogical techniques for videoconference.

Writing for DVD is somewhat similar to writing branched scripts for multimedia that traditionally would have been distributed on CD-ROM. However the unique abilities of DVD such as selectable angles and the ability to seamlessly concatenate scenes from different parts of the disc add a third dimension to the script. These attributes of the script structure will allow users to customise their own learning experience to their needs. The hybrid will be used in training:

- to operate videoconference equipment
- to prepare material for screen based presentation
- to teach using videoconference
- about the aesthetics of the framed image
- all of the above

However, as stated above, the primary purpose of the product is to demonstrate the technology and its use in an educational setting. In this way it will be used as a professional development tool to investigate, evaluate and showcase DVD/WebCT hybrid technology in a learning environment. In this way it will be used:

- to emulate learning via broadband Internet through enhancement of a WebCT site by full screen, full motion interactive video,
- to assist in planning for future technologies, as well as the secondary purpose;
- the improvement of videoconferences as a learning technology thus enhancing the learning experience.

Production of the DVD/WebCT hybrid would also provide learning opportunities for the staff involved with it from the scriptwriter, the web programmer, through to the video production staff who would record the disc.

Why DVD?

When the DVD medium was first introduced its primary role was for the storage and distribution of video. From the outset Hollywood's movie studios have had a (some would say heavy) hand in the development and standardisation of the medium and at first the acronym was short for Digital Video Disc as it was thought that their main use would be to replace the VHS distribution of movies. However, as computer files increased in size and as the capacity of CD-ROMs is limited to 650 or 700MB, DVD was proposed as a higher density storage option and many computers started shipping with drives that could read DVD as well as CD-ROM. To reflect this new use of the medium the acronym was changed to Digital Versatile Disc. However, today it is known simply as DVD.

A basic DVD can store up to 4.7GB of information. However, dual-layer and double-sided discs are available which raise storage capacity to 9 and 18GB respectively. Table 3 compares storage size of DVD with CD-ROM. The capacity of DVD in terms of video depends on the compression rate and hence the quality of the pictures.

> "... DVD is much more than CD on steroids. Its increased storage capacity and speed allow it to accommodate high-quality digital video in MPEG2 format. The result is a small shiny disc that holds better-than-TV video and better-than-CD audio. A basic DVD can contain a movie over two hours long. A double-sided, dual-layer DVD can hold about eight hours of near cinema quality video or more than 30 hours of VHS quality video." (Taylor, J. 2001; p. 3).

Media	Storage Capacity
CD-ROM	700MB
DVD single-sided single layer	4.7GB
DVD single-sided dual-layer	9GB
DVD double-sided single layer	9GB
DVD double-sided dual-layer	18GB

Table 3: A comparison of CD-ROM and DVD

While DVD media has many clear advantages over CD-ROM media, it would not be worth considering unless DVD replay hardware was relatively, freely and widely available. The Pioneer Electronics Australia website makes the following claim about the numbers of DVD players.

> "In two years, some 250,000 DVD players have been sold in Australia with 11 to 12 million expected to be in service within 5 years" (Pioneer, 2000).

This does not include the number of DVD drives sold as components of computer hardware. It is reasonable to expect numbers of these drives to increase rapidly as DVD drives typically can read CD-ROMs and hence expand the functionality of the host computer. Some later model playstations (for example Sony's PS2 and Microsoft's XBox) incorporate a DVD drive and read games encoded on DVD or CD-ROM and can be used to replay video and audio from DVDs (Tyson, 2001).

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Bandwidth and Learning Experience

The DVD/WebCT hybrid will allow students to choose the method or methods by which they access course content. Students with slow Internet connections will be recommended to use the DVD to access content while students with broadband connections of sufficient speed will be given the option to download the content material. Other material such as the subject outline including the calendar of dates could be included in the DVD. However, material of an ephemeral nature, such as dates that change from one teaching period to the next would be most appropriately accessed from the website.

The ways in which students interact with the media-rich content material will depend on the way in which they are downloaded and the local media on which they are stored. Students could interact with the DVD through selections made from the on-screen menu. They can elect to view an overview or the complete module. Students who download the content material would make their choices before they download each section of the content.

With a broadband connection of sufficient bandwidth it is possible for students to interact with each other through streamed desktop videoconferences as well as the narrowband methods of chat, email, discussion forums and bulletin boards. They could interact with their teachers using the same technologies.

One limitation of narrowband is in the interaction with the teacher and between students. These interactions would be limited by the bandwidth and typically would be confined to text or highly compressed video/audio streaming.

To compare the learning experience between broadband, narrowband and narrowband enhanced through the use of DVD/Web hybrid, the Model Of Learning and Teaching Activities (MOLTA) (Caladine, 1999; p. 24) has been selected (see Table 4). MOLTA arranges the activities of the process of learning and teaching into the categories of:

- Provision of Material,
- Interaction with Material,
- Interaction with the Teacher,
- Interaction between Students, and
- Intra-Action.

  (Intra-Action here refers to those activities that students undertake that are not in the other categories and are to a high degree independent of them.)

MOLTA Categories	Narrowband Internet	Narrowband Internet plus (DVD/WebCT)	Broadband Internet
Provision of Material	Text Stills Limited low quality video	Text Stills High quality full screen from DVD	Text Stills Video streamed from server (quality dependent on bandwidth)
Interaction with Material	Text Stills Low quality video	Text Stills High quality video	Text Stills High quality video
Interaction with Teacher	Email Chat Online discussion Low quality streaming	Email Chat Online discussion Low quality streaming	Email Chat Online discussion Streaming (quality depending on bandwidth)
Interaction between Students	Email Chat Online discussion Low quality streaming	Email Chat Online discussion Low quality streaming	Email Chat Online discussion Streaming (quality depending on bandwidth)
Intra-Action			

Table 4: A comparison of narrowband, enhanced narrowband and broadband

As mentioned above the enhanced narrowband DVD/WebCT hybrid does not have the streaming capability of high bandwidth broadband. However, in most cases it is possible, and usually desirable, to prepare content material beforehand thus allowing sufficient timeframe for the distribution of high quality video material by post or other physical means. In broadband cases where streaming is available and affordable it is more likely that it will be used for interaction as well as the narrowband text based tools.

Conclusion

A DVD/WebCT hybrid has been presented as a means of incorporating high quality video material into online subjects delivered via narrowband connections to the Internet. While the hybrid falls short of the functionality of the broadband example in terms of the interactions with the teacher and between students, it does go part of the way to reduce the digital divide between the bandwidth rich and the bandwidth poor.

As well the DVD/WebCT hybrid provides an appropriate and friendly entry point for the acquiring of online learning skills. Skills that most universities agree are an essential graduate attribute for lifelong learning. Of course it is not anticipated that all online learning should become media rich. However, it is argued that the best introduction to online learning is through an environment rich in the media with which students are familiar through their exposure with computer games, television and other electronic entertainment.

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ENDURING CHANGE:
TECHNOLOGICAL MANAGEMENT IN EDUCATION

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Abstract

The Changing Technology Management Project, at Sheffield Hallam University in the UK, has been investigating the issues surrounding the integration of technology into teaching and learning. This is a preliminary report that identifies the limitations of prescriptive methodologies, such as the North American Teaching, Learning and Technology Roundtables, in three diverse institutions in England. The authors posit that cultural sensitivity to the organisation is the vital base upon which to build meaningful and enduring technological change.

Keywords
culture, change, technological change, collaborative change, roundtables, higher education, further education, methodology

Introduction

There is a general consensus that change is an ever-present dynamic and, according to some, this has been particularly resonant in higher education (*cf.* Halsey, 1995). The shift from elite to mass higher education (HE) has forced English institutions to re-evaluate their provision. This has been distilled into a single policy question: How can institutions deliver a high quality product, to a greater population, with diminishing resources? Since the mid-1990s critiques began to appear which heralded the potential of information and communication technologies (ICT) as a solution to these concerns (*cf.* Ehrmann, 1996). As we are becoming conversant with the integration of ICT into teaching and learning, we have found that both the underlying trends of change in HE and in ICT have combined to shape the way we manage technology. These can be summarised in the following key areas:

- macropolitico-economic change and, specifically, the transition towards a knowledge economy. The Council of the European Union (2001) described a vision whereby Europe becomes "the most competitive and dynamic knowledge-based economy in the world capable of sustainable economic growth with more and better jobs and greater social cohesion" (p. 2);
- the changing face of accountability, where institutions are increasingly tightly controlled by governmental agencies (such as the Quality Assurance Agency in England) and the increasing demands of students as consumers heightened by the recent introduction of the undergraduate tuition fees;
- the nature of technological developments mean that change is uncertain and unquantifiable and, because one cannot predict the form of the challenges that lie ahead, in a real sense, it is difficult to manage strategically; and,
- as funding has generally fallen in the sector more has been spent by institutions on technology in the hope of reducing long term costs (reducing tutor-student contact hours) and also generating income through the commercial possibilities of e-learning.

The Changing Technological Management Project

The Changing Technological Management Project was established to investigate how technological management in education can be made more effective. This study was an eighteen-month project that began in September 2000 funded by the Joint Information Systems Committee (JISC). The original focus was to trial the North American Teaching Learning and Technology Roundtable (TLTR) methodology. However we quickly learnt that there were wider issues to be considered, particularly those relating to institutional culture, which will be detailed during the course of this paper.

For many in higher and further education, the experience of integrating technological innovation with teaching and learning has been haphazard and uncoordinated. Even where specific groups or individuals have been established to manage this process, there have been charges that they have focused narrowly on either 'technology' or 'teaching' and 'learning'. As a result, TLTRs were developed by the TLT Group (an affiliate of the American Association for Higher Education) as a methodology for integrating teaching and learning with technology. Roundtables have been defined as "a diverse group representing those who can and should work together to improve teaching and learning with information and communication technologies" (TLT Group, 2000).

Specifically, within the context of English higher education, the project was charged with three main aims:

- to discover how roundtables are used;
- to investigate their effectiveness and value, and
- to identify strategies for the successful management of technological change.

Overview of the Research Methodology

The investigation was primarily qualitative in nature and the specific features of the research methodology were as follows:

- case studies in three principal sites: an 'old' research led university (Institution A), a former polytechnic (Institution B) and a community FE college (Institution C). The key methods employed were structured observation and interviews;
- informal visits to other UK institutions;
- semi-structured surveys of UK experiences (followed up by a series of telephone interviews); and
- face-to-face and telephone interviews with North American institutions who have experience of TLTRs.

It should be stressed that the investigation is still continuing but very illuminating data has already been elicited. The remainder of this paper reports these findings.

Experiences in the Institutions

As one would expect, a very different culture and management system was in place at each institution. This can be explained by their vastly different traditions. Institution A could be characterised as a conservative, collegial university with a high research income and somewhat traditional values. Institution B has more modest income from research and is heavily reliant on student tuition fees as a source of income. It is assumed to be more managerial than its older counterpart and perceives itself to be more dynamic. Institution C, on the other hand, is operating within much tighter financial constraints than its university counterparts. It is highly managerial as evidenced by, for example, the existence of a "Chief Executive Officer" rather than a Principal. All three institutions enjoy close ties owing to their geographical proximity to each other. While a second common denominator for all the institutions was that each was interested in the development of some form of e-learning.

The first task of the project was the identification and recruitment of dedicated champions who would be charged with the responsibility of promoting and implementing the TLTR methodology in their respective institutions. The TLTR methodology encompasses a series of prescribed activities in sub-groups (Gilbert, 2000) that seek to establish:

- clear objectives and agreed goals *vis-à-vis* technological management;
- develop a climate of openness;
- develop appropriate leadership; and
- reviewing team processes.

At this stage there were three immediate issues, namely: the influence that the champions could bring to bear on the institution; the appropriateness of the methodology itself and time needed to establish the roundtables. First, if the champions were to have any chance of establishing the groups they needed to fulfil a number of criteria, which are to be found in other lessons from change management (Goulding, Mistry, Kinnell, Proctor, & Usherwood, 1999). As the *de facto* leaders of the group they needed to have enough seniority to be able to inspire commitment from senior management whilst also being a 'respected insider' to gain the confidence of teaching staff. Additionally we found that they needed to be imbued with enough political acumen to know how to use their influence to keep the roundtable vibrant. Our experiences are in keeping with Baldridge, Julius & Pfeffer's (2000) depiction of the "strategic ambassador" approach to leadership, which places the leader at the centre of concentric social circles rather than the peak of the organisational pyramid.

As far as the appropriateness of the methodology was concerned, more fundamental problems arose when the prescribed tasks were first introduced to the roundtables. At two of the three institutions the membership treated the tasks as being entirely inappropriate. Only Institution A considered the use of the workbook but even here it was at a much lower level (i.e. in a sub-group with minimal influence on institutional strategy) than had originally been envisaged. We have found that all the institutions' receptivity to the methodology was inhibited by two key factors: the prescriptive thrust of the workbook was alien to the organisational cultures of the institutions investigated; and the workbook was not sufficiently sophisticated for roundtable members to feel they would benefit (deriving from their assertions that similar thinking had already been completed). Survey data and informal visits corroborated this assumption by the researchers to other institutions. In conclusion, the prescriptive thrust and lack of sophistication conspired to condemn the methodology to be viewed as just another 'bolt on' programme that would be peripheral to the institutional culture and soon forgotten.

It was noted that all the roundtables needed considerable time to establish themselves and be subsequently incorporated into the institutional decision-making process. There was a correlation between institutional type and the speed of establishment. Institution C, the most managerial institution, established their roundtables within weeks: Institution A, the 'old' research-led university, established theirs after many months' negotiation. In general, our experiences substantiate the conclusions reached by a US study which verified that the lead up time in American institutions was between twelve and eighteen months (Nardick, 2000).

Interestingly respondents at all the institutions distinguished between 'roundtables as an approach' as opposed to 'the roundtable methodology'. While the latter has connotations of directiveness, the former was recognised by many as an opportunity to articulate aspirations of collegiality. The drive of managerialism in England (Deem, 1998) has all but eradicated any meaningful collegial systems (Ramsden, 1999). The 'roundtable approach' which has elements of dispersed leadership, representatives from the campus community and ownership over decision-making, appears to map well onto the sense of community that is embodied in highly valued concepts of collegiality. It may well be a reaction against the endless tide of managerialism, which makes this allusion to legitimacy all the more persuasive and seductive. At Institution C we found that while the development of policy was more time consuming, as one may expect from such a democratic model, the consideration of multiple viewpoints has led to a perception that policy making is more robust than it had been previously. Whether this is a correct interpretation, or replicated in the universities, will be uncovered by future research.

Conclusion: Points for Discussion

We present a set of discussion points rather than concrete conclusions. This is based on our stated depiction of the project as one in progress. Three pertinent questions, which we feel may be applicable to the management of technology in any organisation, emerge from our experiences:

- can methodologies developed for one education system ever be transferred to another?
- can prescriptive methods secure palatable and enduring change? and, having identified these two questions,
- where does one start the process of change?

It is evident that a constant theme in our investigation is one of 'ideology' and the ideological underpinnings of the culture of the institution and of the methodology. While technology creates a stimulus for accelerating change we need to be ever more sensitive to the cultures of the organisation.

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PROBLEM-BASED LEARNING & IT TO SUPPORT AUTHENTIC TASKS IN TEACHER EDUCATION

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Abstract

Teachers take on a wide range of roles in a school, yet most teacher education courses prepare students for only the role of classroom teacher. A problem-based learning approach to teaching and learning and IT-based resources in a technology-rich learning environment have been combined to provide undergraduate education students with an exciting and innovative way to learn about IT in schools. This paper explores how problem-based learning and technologies have been utilised to provide opportunities for learning about IT in schools through: solving authentic tasks; taking on leadership roles; working as a team; and collaborating on solutions to ill-structured problems.

Keywords

teacher education, problem-based learning, authentic tasks, leadership

Introduction

The roles of a teacher include not only teaching and classroom activities, but also many other roles such as curriculum planner, decision maker, human resources manager, technology manager, team member, and team leader. A problem-based learning (PBL) approach is applied in the subject *IT in Primary Schools* at the University of Melbourne to project undergraduate students into their future role as teachers, to enhance their learning, and to prepare them for the varied roles of a teacher through authentic tasks and scenarios. The subject is supported by a website that includes a rich description of a (fictional) primary school (and its inhabitants) in which the problems are set and the subject conducted in a technology-rich teaching space. This subject is part of the Bachelor of Education (Primary) [B.Ed.(Primary)] degree, which is a four year course of study and the principal vehicle for the education of primary (Elementary/K-6) teachers at the University of Melbourne. During the third and fourth years of the B.Ed. (Primary) degree students select one optional subject each year, allowing students flexibility to strengthen an area of interest or to broaden their knowledge. *IT in Primary Schools* is one of the optional subjects and runs over 18 weeks with a two hour block each week. The tasks students undertake are designed to develop their content knowledge, to give students experience in teamwork, and to develop skills and knowledge about being a leader in the context of decision-making about IT issues in a school.

Using a PBL approach for this subject was examined when new graduates told us that in their first year of teaching they were members of the Information Technology Committee (or equivalent) at their school. This is a large role for a new teacher and one for which little of their university studies had prepared them. This subject was developed in response to this need. It gives our students experience in tackling the kinds of IT issues that they are likely to encounter when a teacher, and to experience the roles of committee member and chair of a committee with responsibilities for developing a report with recommendations for a school council or principal. PBL allows students to develop both the content knowledge and the transferable skills required in the many roles of a teacher, with this subject having a particular focus on leadership roles.

The subject was offered for the first time in 2001 and data to evaluate the effectiveness of the subject are currently being gathered from student reflections, tutor's journal and staff reflections. Preliminary findings indicate that students respond well to this style of learning and develop skills and understandings not developed elsewhere in their studies. The first semester feedback from students in the University's 'Quality of Teaching' survey was excellent — scores ranged from 4.4 to 4.9 (out of 5). That the response to the statement 'The subject was taught well' scored 4.6 is both pleasing and interesting, as there was no 'teaching' (but lots of learning!) in the subject. Further data will allow a more substantial evaluation of this approach to teaching and learning in teacher education. This paper will discuss how PBL, web-based resources, and a technology-rich teaching space combine to give a rich learning experience for students.

Using PBL and a Rich Subject Website to Support Learning

Finkle and Torp (1995) describe problem-based learning (PBL) as:

> *"a curriculum development and instructional system that simultaneously develops both problem solving strategies and disciplinary knowledge bases and skills by placing students in the active role of problem solvers confronted with an ill-structured problem that mirrors real-world problems"* (online).

The subject employs a problem-based learning approach (see also Stover, 1998; Stepien & Gallagher, 1993) and each problem is explored in a four week cycle (see Table 1). The students work in teams of four students and tackle four problems involving IT in a fictional primary (K-6) school over the course of the academic year. The role of the team is that of a committee that respond to briefs developed by the principal or school council. The team leader is in the role of committee chair and the team members act as committee members. Teams meet in scheduled class times once each week and also meet – electronically or in person – outside scheduled classes.

Week 1 (of 4 week cycle)
- An introduction to the problem and a discussion that raises general issues. This is supported on the website with notes, links to useful sites and articles, and supporting artefacts about the scenario for the problem.

Weeks 2 & 3 (of 4 week cycle)
- Teams work on the problem, with staff available to mentor the teams. Experts (principals, teachers, and others) are available (via email) to team leaders.

Week 4 (of 4 week cycle)
- Teams present their recommendations to the group, the style is similar to a School Council meeting and students critique and discuss the recommendations of each team.

Table 1: Activities during the four week cycle of each problem

The problems are all set in the same (fictional) primary school and are:

- developing curriculum plans for effective use of IT in classroom teaching;
- allocating and justifying a three year IT budget for the school;
- developing a professional development strategy for IT skills of the staff;
- developing a three year IT Strategic Plan for the school.

All subjects taught in the B.Ed. (Primary) course have a website to support the on-campus, 'face-to-face' teaching. Subject websites are routinely used by students for accessing subject materials, including topic outlines and workshop notes. It was, thus, natural that materials to support this subject would be delivered online as part of the subject's website. The technology allows us to include rich resources for the students to explore the fictional school and to host electronic discussions to support the problems. Making artefacts that support the problems available through the subject's website also allows us the opportunity to model to our students some ways of using technology to support teaching and learning.

The students access, via the subject website, a rich description of the school with artefacts, such as budget documents, IT skill profiles of staff members, and a plan of the school. Teams of four students explore the context of the problem and tease out aspects of the issues they need to investigate and consider. The materials may be text, images, or 'school documents', as appropriate. In addition to the artefacts, external experts are available for team leaders to communicate with via email. These experts are teachers, principals, or others that have expertise in aspects of the problem and have experience in how their schools have approached a similar problem. The experts are drawn from the Australian educational community and are experienced educators who have volunteered to work with our students and mentor them through the problem.

In keeping with the PBL approach, the problems are not so tightly defined that there is a simple answer – there is no single 'right' answer to any of the problems. It is expected (but not required) that students will develop recommendations that differ from team-to-team and that students will learn much from considering and critiquing the recommendations of other teams. Each team develops recommendations that students present to the group and to academic staff members in a 'School Council' style of meeting and that teams prepare as documents for submission. Students take on the role of team leader on a rotating basis and are responsible for compiling and submitting the report and coordinating their team's presentation. This allows students to gain experience in working as a team and in leading and coordinating a team to meet a deadline. These are highly valued transferable skills for students to gain, in addition to the content knowledge developed.

Four problems are explored over the year and at the conclusion of each problem students individually prepare a brief reflection on the problem, their learning, and the team process. This is an opportunity for students to consider the ways in which they learn, and how they could improve as a team member or team leader. This opportunity for reflection on learning is an important aspect of PBL (Holen, 2000).

Technology in the Teaching and Learning Space

As the subject's content area is 'IT in Schools' it is natural that we wish to model excellence in using appropriate technologies to support teaching and learning. We are fortunate to have access to a learning space equipped with technologies that facilitates collaborative teaching and learning for up to 25 students in five groups, and for whole group discussion (Arnold & Gruba, 2001). Each team is based at an oval table with one computer for each team (Figure 1). With only a little rearrangement (pushing back some chairs) the teams can join as a single group to share ideas and discussion. This is facilitated by a data projector, a touch-screen electronic whiteboard (a 'SmartBoard', Smart Technologies, 2001), and a data collaboration network (NetSupport, 2001). The technology in the collaborative teaching space gives the students an opportunity to use and become familiar with technologies that may not yet be available in schools, but are likely to appear there some time in the future, and experience learning in a technology-rich environment. This is important, in particular, for education students as, if they have learned in a technology-rich environment they are more likely to be comfortable teaching in one.

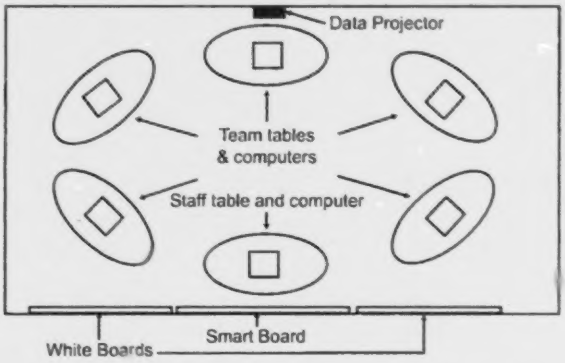

Figure 1: Physical arrangement of collaborative teaching space indicating team tables (each with one computer), staff table and computer, and projection device and 'SmartBoard'

Conclusions

The resources and style of teaching utilised in this subject for undergraduate teacher education at the University of Melbourne allow our students to investigate, in a technology-rich environment, authentic issues involving IT in a school and develop recommendations. These experiences in working as a team member and being relied on to contribute, in leading a team and coordinating the process and the outcomes, and in presenting the findings to peers and staff give the students invaluable opportunities to develop knowledge and skills in a way quite different to traditional university teaching styles. The effectiveness of this approach to teaching and learning is indicated by the following quote, which is from a reflective piece of work from a student in the subject:

> *Working through this problem enabled me to think about the sort of teacher that I want to be and how I would like my students to learn. Constructivism and PBL model effective teaching practice about teaching and learning.*

Using problem-based learning, supported by appropriate technology and by experts, has allowed our students to analyse authentic situations at a school level and consider alternative solutions or paths of action while working in a team. Elements that strongly influence students' experiences and learning are that students do not work on these materials alone, but rather must discuss their findings with colleagues and work as a team to arrive at conclusions, and the collaborative, technology-rich environment facilitates both small team work and larger group discussions. The need to reflect on observations and share with others and develop the skills required in being a successful team member will, we believe, serve our students well in becoming leaders in the rapidly changing environment of schools of the twenty first century.

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COLLABORATING IN THE TRANSITION TO TERTIARY WRITING

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Abstract

The Monash Transition to Tertiary Writing Project seeks to produce a web-based resource for first-year students to facilitate their transition to the kinds of thinking and writing valued at university. The background research on which this language and academic skills (LAS) project is based centres on three main types of collaboration. Of key importance was the interaction set up between six LAS lecturers and more than twenty first-year students across ten subjects. Crucial too are the relationships established with thirteen lecturers from four faculties teaching the first-year subjects. In addition, interviews were conducted with Year 12 teachers who made observations about the likely difficulties they expected students to experience. Collaborations with these three groups of stakeholders yield a number of insights about the challenges for students making the transition from school to university. The resulting web-based resource represents an innovation in its attempt to capture both dimensions of this transition: a vertical one (school to university) and a lateral one (moving from one discipline specialism to the next).

Keywords
transition, student writing, web-based learning

Introduction

In undergraduate education, there is a need to find ways - both new ways and ones that are supplemental to any existing *good* practices - that make explicit for students the types of writing and researching that are required of them in their courses. For many students, the university situation represents a marked contrast to their secondary school experiences, where institutional practices and participant roles were clear: expectations were codified comprehensively in the form of quite specific assessment criteria and sub-criteria. At the university however, these practices and roles are not clear: expectations are often expressed as vague exhortations. The key concept of "critical analysis" is a case in point. Students are told frequently that they must adopt a "critical" attitude to their research, yet as Candlin (1998) points out, "disciplines are often unclear and inexplicit about what [this analysis] consists of" (p. 6).

Related to this lack of understanding about expectations and approaches is a lack of knowledge of the nature of university writing (Jones, Turner & Street, 1999). For students new to the academy, the problem often stems from a lack of access to appropriate generic models. They find themselves having to rely on, on the one hand, the "formative" genres of their secondary education (over which they have gained some mastery) and on the other hand the "expert" genres that make up the reading content of their course (which are clearly beyond their present abilities). Between these two poles, it can be difficult for students to find an appropriate novitiate discursive voice, one fashioned by an understanding of the textual structures, discursive processes, and institutional practices of their new writing context (Candlin, 1998). Language and academic skills (LAS) staff are often well-positioned within the teaching and learning environment to assist both students and subject lecturers.

The Monash Transition to Tertiary Writing Project, involving collaboration between the Language and Learning Services Unit and lecturers from four faculties, aimed to develop a web-based writing resource as one way of addressing students' difficulties.

The project team was a large one. The collaborations for the project, as well as being with teachers, students and lecturers, involved an educational developer, web developer, audio technician and multi-media graphic designer. The language and academic skills staff worked one-on-one with the subject lecturers and with the students. Between one and three first-year student volunteers were selected to participate (from a number volunteering) from each of the discipline areas above. The Associate Deans (Teaching) of the four faculties were also involved at the outset and their feedback was sought as the modules were published in relatively final form.

In this paper we provide an outline of the background research: what we learned from Year 12 teachers, from first-year students' writing experiences, and from the "institutional voice" – the lecturers' response. We also outline how this research fed the development of the project.

Aims of the Project

The project targeted ten first-year subjects: History, Literature, Philosophy, Sociology (Faculty of Arts), Commercial Law, Economics, Management and Marketing (Faculty of Business and Economics), Perspectives on Learning (Education), and Legal Process (Law). The objective was to develop a web-based module for each subject.

The project aimed to facilitate a more critical orientation to tertiary literacy for the students undertaking those subjects, with the following anticipated outcomes:

1. Students should be better positioned to understand what was required of them in their writing at university level.
2. With respect to lecturer expectations, it would be clearer to students how subtle changes in the use of language and structure can affect the success of a piece of writing. The lecturer feedback would be presented so as to provide maximum useable benefit for the student.
3. A "mentoring" experience would be provided, with the student able to draw on other students' experience of the personal organisation necessary to the essay-writing process, and thus on alternative approaches to writing tasks.
4. Some of the benefits of a one-on-one discussion with an academic skills or subject lecturer would be provided in the resource's focus on task/subject specific issues.
5. Students are often perceived as only "describing" when they should be "analysing": the resource would give students visible evidence of what terms such as "analysing" in their subject means.
6. The development of transferable thinking strategies may be encouraged as students are being encouraged to reflect on their learning.

To inform our development of the web modules, we carried out initial research into the Year 12 writing experience, and then the first-year writing experience – drawing on both lecturers and students.

Interaction with Year 12 Teachers

In order to elicit a *developmental* perspective on the precise nature of students' difficulty in these subjects, one of the project's first tasks was to conduct a series of focus groups with a total of 25 teachers of cognate Year 12 subjects at five schools in Victoria. The project leader conducted the interviews, took notes and brought them back to a project team meeting. In subsequent project development meetings the teacher information could be referred to in order to guide some of the decision-making processes. (It is intended that the teachers who contributed will be shown the resource once it is all published and invited to give feedback at that point). The Project Manager also interviewed three further teachers (of Year 12 English/English Literature) to assist her in the development of her English module.

Teacher input was of particular relevance as students undertaking Year 12 in 2000 would be undergoing different writing experiences from those encountered in previous years under the CAT (Common Assessment Task) system in Victoria. (Under the CAT system, students were encouraged to research assignments by engaging in additional reading and then to develop the assignment through a series of drafts). Students entering university in 2001 and thereafter will have undertaken school-assessed coursework (SACS), "designed to reduce workload", which must be completed mainly in class within a limited timeframe.

In semi-structured focus groups, teachers were asked a short series of questions about the problems they thought students faced in adapting to university writing requirements. There was general agreement that they felt themselves to be not in the business of "preparing kids for uni". Their responsibility was seen as ensuring their students learn in such a way as to complete the requirements for their subjects and get the best marks possible. Looking ahead – and knowing their students well - they felt that they would have little idea how to use a university library, would be unlikely to know how to select texts, to determine what is most relevant, or how to skim read. Because of the ubiquity of the "set text", there was naturally a lack of exposure to different examples of disciplinary discourse in Year 12, and teachers believed students would not be aware that there were differences. In Year 12, students were not encouraged to browse the Internet, and except for certain subjects, were not given any guidance as to how to evaluate sites. In contrast to previous secondary years, Year 12 students were either told specific sites to consult, or advised that Internet research was "optional".

With respect to writing, the teachers identified the following areas as potential problems.

Understanding Expectations

Expectations for Year 12 writing continue to rest upon specific criteria to which marks are attached (eg. Criterion 1, 10 marks; Criterion 2, 10 marks; Criterion 3, 4 marks). Teachers assist students to identify where they have not met criteria. The question is treated as a springboard to talk about the topic. Students are often asked for "their opinion", and acknowledging sources is treated by them in a very "cavalier" fashion. They are taught referencing at every year level, but will plagiarise and believe that it is OK if you "can get away with it". With respect to their audience, students are often told "explain as if the reader doesn't understand", so they perceive that it is important in writing to show what you know. Other than for the top students, there is a tendency to agree with propositions in preference to grappling intellectually with issues raised ("they want to play parrot").

Drafting and Editing

In many subjects in Year 12, there is little experience of expanding, elaborating, feeling one's way. Word counts are strict; the teacher is there to give instant feedback. Some students are likely to approach university tasks by going to the other extreme and "over-playing" their writing, thinking that verbosity is what is required to be acceptable. For writing, in a number of Year 12 subjects, working on an assignment often involves getting the content right and not bothering about the form of words.

Writing at Length

Under the SACS system, there is the occasional 1,500 word assignment, but most are only 800-1,000 words. Deadlines are carefully managed and supervised; students are told when to begin, reminded when work is due; they discuss their work and receive comment on it in class; and they talk with their peers about it out of class. According to teachers, students fresh from Year 12 would have no idea how to set out the work and how to reference and format an assignment unless they were told.

The majority of this strikes us as so much received wisdom, but it is still interesting how uniform the teachers' views were across schools. Interesting too, how teachers' predictions suggested that a lot of the bother they believed students would find themselves in occurred precisely because libraries, essays, topics, deadlines were going to *look* the same, but they were not the same.

Our understanding from these discussions is that while some topics in VCE are more directive, sometimes it is the teaching strategies that may make them *appear* directive to students. For example, with DISCUSS questions, students are often encouraged to set up a strong line of argument on one side as a way of dealing with them. As one teacher explained:

> Certainly, I taught my students to set up a contention in relation to the topic, and encouraged them to see it as an argument in which they were trying to convince me of their point of view on the text. Without that kind of direction, they tend to just waffle without really saying anything.

In this way, students entering university are likely to have a perception that "there is a specific question requiring a definite and determined stance" from them.

Insights from First-year Students

The insights yielded from our discussions with students also served to guide the shaping of the material. A total of 27 students were interviewed by the six LAS lecturers: ten of these were audio-taped for the resource (some of the taped interviews were also transcribed, but most exist as audio). Notes were taken from the initial 27 discussions.

The kinds of adjustment problems predicted by the teachers relate to what might be called the "vertical transition" - that is from school to university. There is, however, also the "lateral" transition that students must negotiate as they move from one discipline specialism to the next, each arguably with its own distinctive discursive mode, "variations in knowledge structures and norms of inquiry, different vocabularies, differing standards of rhetorical intimacy" (Bhatia, Candlin & Hyland, 1997). In the literature on adjustment into academic culture - in both its vertical and lateral dimensions - a common metaphor for pedagogic processes is "the apprenticeship" (see for example "cognitive apprenticeship", Lave & Wenger, 1991). In such processes, the lecturer (or disciplinary expert) is thought to provide mentoring for the "apprentice" through processes of: i) modelling, to make tacit knowledge explicit; ii) coaching, by supporting students' attempts at performing new tasks and then iii) fading after having empowered the students to work independently (Brown, Collins & Duguid, 1989).

It is fair to say, however, that within undergraduate education, these types of "apprenticing" activities are often more desired than actual. Candlin (1998) reports, for example, that students do not perceive themselves to be tutored in this way: "there is simply not the close contact with experts on real-world problems that the term apprenticeship conventionally implies" (p. 21).

In our research for the project, we wanted more specific comments from first-year students about writing, and how prepared they felt themselves to be. We collected information from students in two ways: through an initial written survey conducted during tutorials for nine of the subjects (excluding Sociology due to time pressures); and through interviews with individual students who had also kept diaries of their essay-writing processes. Audio "bytes" of nine of these would be used on the site. In the survey, students were asked, *inter alia*, to rate how well they felt their year 12 assignment writing had prepared them for writing their current assignments. In order to get an accurate assessment of the students' *perception* of their preparedness, the survey was given to students prior to marks being released. A total of 287 responses were received.

The quantitative results of this survey are not overly surprising: on a scale of 5, where 1 is not very well prepared and 5 is very well prepared, the average across the disciplines was 3.2. Those students who felt that year 12 prepared them very well, with a rating of 4 or 5 out of 5, tended to view writing in terms of what they called "the basics": the mechanics of writing, such as paragraphing, structuring an essay, writing effective introductions and conclusions, being concise, focussing an argument, referencing, and so on. In contrast, those students who felt that year 12 had not prepared them well at all, with a rating of 1 or 2 out of 5, tended to view writing in broader terms that incorporated approach to the task as well as "the basics". These students commented on the lack of guidance about what content to include; the fact that university essays required independent thinking; and that students had a greater freedom to interpret questions, to provide opinions, to seek out appropriate sources, and to create their own arguments.

The individual audio-taped interviews with students conducted by the LAS lecturers emphasised the distinctions between writing in year 12 and university. The students felt that, in addition to having fewer written guidelines and advice about what content to include, the questions themselves were "broad" and "less specific" at university, and that this was a fairly challenging change. Many students often perceived Year 12 questions to require a definite, unequivocal stance. As a consequence, as indicated by the survey results, a number felt unprepared for writing essays that required them to determine for themselves what content to include, and to construct a more complex and qualified argument. The students discuss these issues in the audio-clips found on the Annotated Assignments section of the web site.

Collaboration with Subject Lecturers

The third area of collaboration for the project explored the way university disciplines present their literacy practices and conventions to students. In this section, we discuss briefly some of the issues thrown up by the discussions with the subject lecturers. The reader can refer to Figures 1-5 below to see how the resource presents the student and lecturer contributions.

There is a general impression held by students that university subjects involve research, that students need to refer to "a range" of sources, that assignments involve "reasoned arguments". To the novice student, this sounds as if these assignments are much the same, and that the types of writing are much the same. Thus it was important that the resource tease out the detail of these differences. LAS lecturers, as well as being involved with the students, turned their attention to the subject lecturers to assist them to explicate their side of the story. For the Annotated Assignments section of each subject module, the lecturer were asked to stipulate exactly what he/she wanted from a particular topic, indicating what would elicit a Credit, a Distinction, and so forth. They were asked to review between one and four assignments writing "typically" brief annotations, but then adding explanatory comments to explicate for general student benefit. For example, for an annotation such as "Not enough detail", the typical student response is "well if I'd known what detail was wanted, I would have put it in!". The expanded comment provided on the web page gives the student more to work with.

For the development of the "Lecturer's Advice" section, a set of questions was designed to tease out the general impression mentioned above that all subjects require pretty much the same type of writing. The LAS lecturer adapted a basic set of questions relating to what the lecturer was *particularly* looking for, how much students should read, how they could avoid merely "describing" in that subject and so on, making the questions as subject-specific as they could. At the same time it was thought important to draw from the lecturer those aspects of the assignment which were generalisable to what could be called "the discipline" so as to give students optimal learning opportunities from the resource. The lecturer's written response was usually supplemented by a follow-up interview to clarify or expand where necessary. Finally, the LAS lecturer adapted these responses slightly, based on their experience of the students, and the material was then edited for the web. The success to which this was achieved can be seen in the relevant sections in each module. In each case, the lecturer was shown the module before the students used it and was able to offer further comments. There was widespread enthusiasm for the results of the collaboration, subject lecturers feeling that they had gained in understanding of "where their students were coming from" and how LAS lecturers could help. In a number of cases, amendments were made to subject materials, web sites and assignment questions as a consequence of these new understandings.

The Writing in Subject Areas Website

The web-based resource is made up of ten modules, one for each of the first year subjects listed. Students access the modules by selecting a subject/discipline from the Index page. The module then divides into three sections: Lecturer's Advice; Skills for Writing; and Annotated Assignments. The key component of the module is the sample assignment(s) produced by the student participants.

The first section of each module has as its focus the "institutional practices" of writing in the discipline, using the subject lecturer as informant. The list of frequently asked questions, along with a summary of the main types of writing difficulties experienced by undergraduates, includes elaboration of key concepts such as the meaning of "analysis" in the particular disciplinary context, as defined by the lecturer and refined for web consumption by the LAS lecturer.

The second section is organised around a range of interactive tasks, aimed at facilitating students' understanding of the nature of textual structures in their discipline (Moore & Clerehan, 2000) as in Figure 1. These tasks are different for each subject and the topics are selected in consultation with the lecturer.

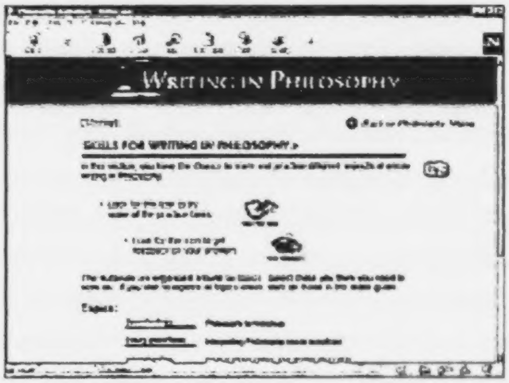

Figure 1: Skills for writing – Philosophy

The focus of the third section is on "the student", the "processes" involved in writing in the discipline; and the institutional expectations and response (see Figure 2 below). For each subject, there is at least one sample assignment (main essay or equivalent in each subject) where both student audio and lecturer commentary are available, in addition to the assignment itself and the lecturer's annotations. In the case of the other sample assignments, users of the resource will see only the assignment, the lecturer's annotations and the lecturer commentary which appears in a pop-up box. Students can print out the assignment to read if they wish.

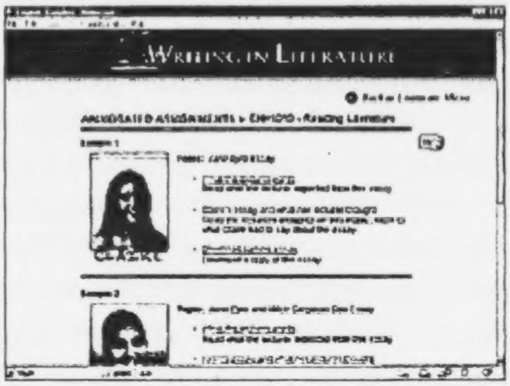

Figure 2: Sample assignment interface

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For the featured assignment, it was decided to suggest a sequenced approach (Figure 3 below). The first part, dealing with "What the lecturer wants", invokes both discursive processes and institutional practices as it presents the lecturer's explanation of what the topic requires (and descriptors for different grades), and invites the student to engage with how well the essay in question responds to these expectations. Students are, at this stage, presented with an unmarked essay. They are then invited to take a further step and think how the essay may have been improved. Finally, they are asked to view the annotated essay.

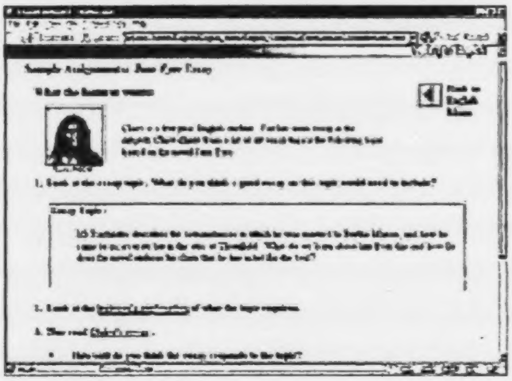

Figure 3: What the lecturer wants

At this point, the student users can click on the audio icons and listen to the essay's author tell how they went about researching and composing the sample assignments, beginning with their first engagement with the essay topic to their submission of the final piece of work (see Figure 4 below for layout). The students also reflect on their broad approach to university writing, and also on what comparisons can be drawn with their experiences of secondary school writing. In accessing this section of the module, other students will have the opportunity to hear the voices of fellow students, in an interaction modelled to some extent on the notion of peer mentoring.

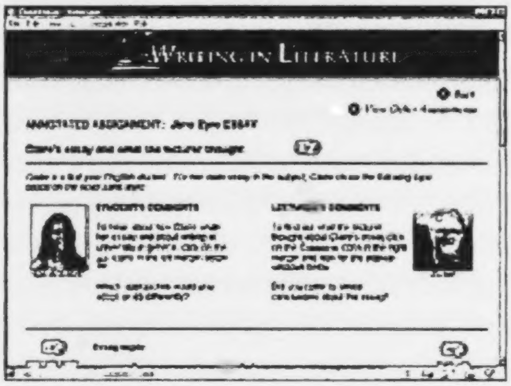

Figure 4: Claire's essay, introductory material

There is a counterpoint to this page, with the students' understandings of the task considered in relation to the lecturer's response to it (see Figure 5), both in the form of annotation and also elaborated in pop-up boxes. We hope this will lead to a more informed and critical appraisal of what is involved in institutional expectations and what is involved in actually researching and composing an assignment in this discipline. At the end of the paper, the student's impressions of their completed essays is juxtaposed with the lecturer's own final assessment.

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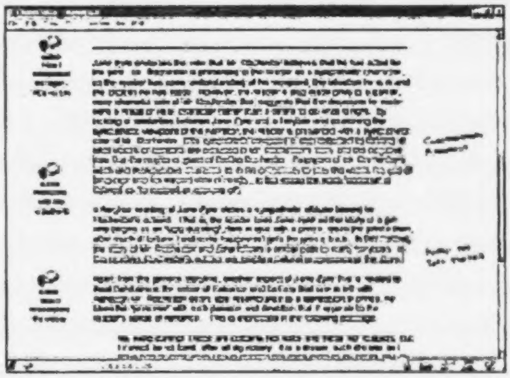

Figure 5: Claire's essay and comments

Conclusion

A great deal of formative evaluation has informed the development of the resource so far. The collaborations engaged in for the Transition to Tertiary Writing Project in some cases exist as background: in others, they feed directly into the resource materials. The Year 12 teachers' perspective is a valuable back-drop, highlighting the student difficulties which may arise from restricted exposure to selecting and using sources, and from having experienced very different types of writing in Year 12. The first-year students - the focus of the project - expressed their need for explicit illustrations of lecturers' expectations and also of exposure to key aspects of writing in the disciplines. Finally, the institutional representatives - the lecturers - have been able to explicate further their expectations of students, demonstrating more clearly to them that there are in fact special qualities of the writing and thinking which mark the differences between the subjects.

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THE *MINI-CONFERENCE* AS A RESEARCH TOOL: ENCOURAGING COLLEGIALITY AMONG ICT EDUCATORS

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Abstract

This paper examines the development of the 'mini-conference'; a novel method for collecting qualitative data whilst promoting collegiality among participants. The mini-conference was developed for the purpose of obtaining the views of information and communication technology (ICT) educators from across Australia's universities as part of the ICT-Ed Project. The ICT-Ed Project is a DETYA funded investigation into innovation in the delivery of ICT education in Australian universities. The field of ICT education is diverse, encompassing a range of disciplines: both those traditionally classified as IT (e.g., information systems, computer system engineering and computer science) and newer disciplines which cross over a number of educational domains (e.g., business systems, web development and design, e-commerce).

In this paper, the stages in the development of the mini-conference will be outlined, including:

- *factors driving the development of the program*
- *the considerations underlying the format*
- *the recruitment of participants into the project*
- *the perceptions of participants about the usefulness of the format*

Preliminary findings regarding the usefulness of the mini-conference as a data collection method in the ICT education sector will be discussed.

Keywords

qualitative research, collegiality, ICT education

Introduction

The *ICT-Ed Project* is a national government-funded study investigating innovation in the delivery of information and communication technology (ICT) education in Australia's universities. For participants in any research project, there is a tension between the potential costs and benefits of participation. This is especially pronounced where participants are under a great deal of time pressure and work within a competitive industry. In the present paper, the development and implementation of a method of data collection which attempts to balance these concerns – the *mini-conference* – is presented.

The mini-conference was devised as a tool for collecting qualitative data from ICT educators regarding:

- their ICT education initiatives,
- their perceptions of the factors affecting innovation in university ICT education, and
- their perceptions of the factors involved in the dissemination of ICT education innovations

The development of the mini-conference will be presented in three parts. First, special challenges that have arisen for ICT educators in the current Australian higher education climate will be briefly outlined. The development of the mini-conference will then be described in relation to the *ICT-Ed Project*. Finally, preliminary findings regarding the usefulness of the mini-conference as a data collection method in the ICT education sector will be discussed.

The Challenges of a Unified National System for ICT Educators

With the move from a binary system to a Unified National System of higher education, Australian university educators have found themselves working in a 'corporate' world (James, 2000; Smart, 1997) where competition for students, government funding and sponsorship from commercial organisations is fierce. In such an environment, teaching and learning innovations emerging from individual universities can be seen as 'products' that give a university 'the market edge' (Collins & Lynch, in-press). Such an environment threatens collegiality in university educators because activities such as the discussion of 'products in development' with peers from other institutions may amount to colluding with the competition (McNaught, Phillips, Rossiter & Winn, 1999). It appears that where once collegiality was encouraged, it is now restricted – if not in intention, at least in practice.

The problem of restricted collegiality is of particular relevance to ICT educators. The speed of technological change means that ICT educators are continually revising the content and means of delivering their subject materials. Rapid changes or advances in technology give ICT educators little time to obtain peer feedback on educational initiatives before they must be implemented. For example, if the ICT industry forecasts a need for graduate proficiency in a new programming language or application in the next five years, ICT educators may be required to incorporate the new technology into their already established curricula in time to meet this industry need.

So, for the ICT educator, there is a pressing need for the timely dissemination of educational innovations; however, dissemination activities are hindered, whether explicitly or implicitly, by inter-university competition. A number of authors have called for a return to the collegial practices of the pre-1987 higher education system (e.g. Harvey, 1998; McNaught, et al., 1999) and there is now explicit government recognition of the importance of disseminating innovative teaching and learning practices. This recognition is manifest in the establishment in early 2000 of the Australian Universities Teaching Committee (AUTC).

Among the AUTC's terms of reference (AUTC, 2000, online) are:

> *to encourage dissemination and adoption of [effective methods of enhancing learning] across the Australian university sector, [to] promote collaboration and exchange of information in teaching and learning both nationally and internationally, and [to] encourage and foster innovation in higher education teaching and learning.*

Shortly after its inception, the AUTC commissioned a small number of projects investigating teaching and learning innovations in the disciplines of ICT, nursing and law. The investigation of ICT education - the *ICT-Ed Project* (online) - is being undertaken by the Computing Education Research Group at Monash University and it was in response the project brief and the prevailing competitive environment of the Australian higher education sector, that the concept of the mini-conference emerged.

Project Brief

Information and communication technology education is a diverse field encompassing a range of disciplines: both those traditionally classified as IT (e.g. information systems, software engineering and computer science) and newer disciplines which cross over a number of educational domains (e.g. business systems, web development and design, e-commerce).

The AUTC project brief called for the identification of the extent to which innovations in ICT teaching and curriculum development have been initiated in response to the needs of students and employers. Associated goals included the identification of factors driving and inhibiting innovation in ICT education and issues related to the dissemination of innovations among ICT educators. The project responded to this brief by conducting investigations of the perceptions of ICT university educators (Phase 1), employees (Phase 2) and graduates (Phase 3).

The mini-conference program was the means by which the perceptions of ICT educators were elicited in Phase 1 of the project. Preliminary findings of Phase 1 of the *ICT-Ed Project* have been reported elsewhere (Collins & Lynch, in-press; Lynch & Collins, in-press a; Lynch & Collins, in-press b). A final report on the project comprising research outcomes and policy recommendations will be presented to the AUTC in November 2001.

The Mini-conference

Rationale

In light of the literature regarding loss of collegiality in the post-1987 Australian higher education sector, it was of paramount importance to the researchers that the project be conducted within a collegial atmosphere (Bessant, 1996; Chipman, 2000; Gilbert, 2000). It was envisaged that input would be drawn from university ICT educators from across the country and it was hoped that by maximising the cooperative input from the ICT departments and faculties across Australia, the final project report would be seen as belonging to the national academic area.

The main goal of Phase 1 of the *ICT-Ed Project* was to identify teaching and learning innovations in Australian ICT education and ICT educators' perceptions of the factors affecting these innovations and their dissemination. Based upon this information, the researchers are required to make recommendations to AUTC regarding the dissemination and uptake of successful innovations across Australia's universities. The researchers believed that any recommendations contained in the project's final report must reflect the self-reported concerns of the practitioners themselves. To this end, it was decided to obtain this information 'straight from the horse's mouth' by way of day-long forums in which university ICT educators could report on innovations in their department (school, faculty, university) and register their opinions regarding the factors affecting educational innovations and their dissemination.

Description of the Mini-conference

Briefly stated, the mini-conference program consisted of a series of day-long workshops comprising brainstorms, discussion sessions and brief, informal presentations given by participants. In order to capture the perceptions of ICT educators across the country, mini-conferences were held in all Australian capital cities with the exception of Darwin where a mini-conference was conducted via video-conferencing technology.

Each mini-conference was of six hours duration (3 hours for the video-conference with Darwin participants) during which participants provided informed consent to participate in the project and were asked to take part in discussions on issues relating to ICT education and to share information on their own teaching and learning initiatives. The number of participants at each mini-conference ranged from 4 to 14. These small numbers ensured that participants would have ample opportunity to express their opinions and time to present their initiatives. Each mini-conference was facilitated by two researchers (the first two authors of the present paper) who did not contribute to the content of the discussions but did record and seek clarification of issues raised.

The proceedings of the mini-conferences were guided by workbooks provided by the researchers on the day of the mini-conference, in which participants recorded their responses to stimulus items, provided written descriptions of their initiatives and made note of the ideas emerging from discussion sessions. The stimulus items, which mapped directly to the research questions posed in the project brief, were as follows:

1. *What are the factors driving educational innovation in ICT education?*
2. *What are the factors inhibiting educational innovation in ICT education?*
3. *Please describe a teaching and learning initiative in which you or your department are currently involved. (Included sub-prompts.)*
4. *Deciding whether your teaching initiative is effective. (Included sub-prompts.)*
5. *What issues would be involved in disseminating your initiative to other ICT educators?*

For stimulus items 1, 2 and 5, participants were given time to consider and record their responses before presenting their responses to the group in open discussion. Individual responses and ideas emerging from the brainstorming process were recorded on a white board and later transcribed for qualitative analysis. For items 3 and 4, participants were again given time to record their responses before presenting them individually to small groups of 4-7 participants. Each participant was given time to describe their initiative including its background, goals, strengths, limitations and plans for evaluation. Individual presentations were followed by short discussion sessions.

Participants were informed of the structure of the mini-conference before attending but were not informed of the actual topics to be discussed. Participants were also advised that no formal preparation was required prior to attending but that they should come willing to informally discuss a teaching or learning initiative being undertaken in their department, school or faculty.

The workbooks acted as both a data source for this phase of the project and as a resource for the participants in terms of networking and sharing ideas with one another. To ensure that all of the ideas emerging from the discussion were captured, the sessions were audio- and video-taped. Video recordings were made to aid in the transcription and analysis of the audio recordings and did not constitute data, *per se*. The contents of all workbooks and audio-recordings were subjected to coding and qualitative analysis using *NUD*IST VIVO* (Qualitative Solutions & Research, 1999).

In the period immediately following each mini-conference, the researchers produced summaries of the educational initiatives presented by each participant. These summaries were forwarded to the participant concerned to confirm the accuracy of the data collected. On receiving approval of the summaries from participants, the summaries were posted on the project website.

Recruitment of Participants

There was some risk in choosing to collect data in the manner described above. The heavy workload of the average Australian academic and the governmental and institutional pressures discouraging staff involvement in collegial activities are well documented (Lynch & Collins, in-press). This posed the research problem of how to encourage potential participants to take a day out of their busy schedules and involve themselves in the project in a spirit of institutionally-supported collegiality. To ensure that potential participants and their departmental heads were aware of the collaborative nature of the program, a 'letter of introduction' was mailed to all heads of all Australian university academic units that offer subjects in ICT. In addition to outlining the mini-conference program and the larger *ICT-Ed Project*, the letter asked recipients to notify the researchers of the names of innovative teaching staff within their academic units. This approach proved fruitful; by casting a wide net at the faculty and departmental levels, a database of over 200 ICT educators interested in teaching and learning innovation was developed. Invitations to participate in the mini-conference program were sent to all individuals identified by the above process with the request that invitees circulate the invitation to colleagues they thought may be interested contributing to the project.

The researchers were also concerned that involvement in the project be seen by potential participants as worth their while; for many, participation would involve hours of travel and the re-arranging of commitments. To overcome this source of resistance, it was pointed out to potential participants that attendance at a mini-conference would provide them with an opportunity to see what their peers are doing in terms of educational innovation, to obtain feedback on their own initiatives and to be recognised for their contribution to a major report on the state of ICT education in Australia.

Of Australia's 39 universities, 29 were represented in the mini-conference program. In total, there were 82 participants including teachers, educational designers and heads of units, representing 51 administrative units. Two of the 82 participants were from universities not funded by the Australian government (Bond and Notre Dame universities). Of the remaining 80 participants, 50 were from institutions which, prior to 1987, were colleges of advanced education or institutes of technology where the focus was on teaching rather than research. Of the 30 participants that were from institutions that were universities prior to 1987, at least 10 worked on campuses that were formerly CAE or institute of technology campuses.

Preliminary Findings on the Usefulness of the Mini-conference

From a research point of view, the mini-conference program has proven a profitable method for the collection of qualitative data from among university ICT educators. The researchers are confident that the breadth and depth of ICT education innovation in Australian universities has been captured. Likewise, saturation was reached in regard to participants' perceptions of the factors affecting educational innovation and dissemination.

A specific goal of the researchers was to conduct the *ICT-Ed Project* within a collegial atmosphere in which participants could obtain peer feedback on their own educational initiatives, hear about initiatives under way in other universities and feel as though they are a part of the greater ICT education community. The behaviour of participants in the program suggests that this goal was achieved. All participants presented at least one initiative (and sometimes as many as three) in which they or their department are involved. While the issue of intellectual property and the constraints of developing innovations in a competitive environment were at the forefront of many participants' minds, they still felt free to discuss one another's initiatives in a honest and constructive manner. The researchers observed a good deal of networking among participants. This was manifest in business-card and email address swapping, the issuing of 'guest' passwords to the sites at which individual participants are developing their initiatives and invitations for inter-institutional collaboration on ICT education projects.

The feedback of individual participants provides additional support for the usefulness of the mini-conference program in encouraging collegiality. Informal feedback from participants included expressions of gratitude that the opportunity was provided to engage in collegial discussions and to find out what colleagues are 'up to'. Furthermore, many participants described feeling optimistic about government recognition of the importance of collegiality and took away from the mini-conferences new ideas about new educational techniques and methods for promoting them in their own institutions.

The online publication of summaries of all initiatives presented during the mini-conference program means that the ideas and activities resulting from the program do not 'sit on a shelf to gather dust'. The ideas remain accessible and authors have made themselves available to discuss their activities with interested colleagues.

Limitations

A limitation of the use of the mini-conference in the *ICT-Ed Project* is that, because of its public nature, it is unclear how candid participants were in presenting their ideas and initiatives. While participant behaviour suggests that there was little 'holding back', this cannot be confirmed without further, anonymous, feedback. However, in terms of the research question, the data collection objectives of the mini-conference program were satisfied.

The make up of the participant cohort also needs to be considered in an evaluation of the mini-conference program. As noted in the participants section, a large proportion of participants were from universities that, prior to 1987, were colleges of advanced education or institutes of technology. These participants had commenced their academic careers in institutions where the focus was on teaching rather than research.

The high representation of educators from former CAEs may be due to there being little opportunity in a research-focused Unified National System for educators who trained as teachers, to discuss their work. On the other hand, the under-representation of educators from older universities may be a reflection of these universities' level of commitment to the development of good teaching practices and higher education pedagogical theory. As Bessant notes, "it will take longer for the older universities to embrace modern teaching methods than for former CAEs to take on research" (1996). It is unfortunate that data concerning those individuals who declined to participate is not available. However, it may be assumed, based upon the comments of those who did participate, that in addition to factors at the institution level, time pressures prevented some educators from attending.

Conclusion

The mini-conference, as a method of collecting qualitative data from among university educators, was profitably utilised in the *ICT-Ed Project*. Despite institutional and time pressures, the mini-conference format attracted participants from a wide range of universities and disciplines within the ICT education community. In terms of promoting collegiality in a competitive, corporatised environment, the mini-conference program was most successful. It is encouraging to see that the race for the 'market edge' has not extinguished the university ICT educator's desire to pursue academic freedom.

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MONITORING GENDER PARTICIPATION AND PROMOTING CRITICAL DEBATE IN AN ONLINE CONFERENCE

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Abstract

This paper presents some preliminary findings from a study with the two aims of examining: (i) gender differences in online participation and (ii) methods for obtaining better online debate. A number of research methods were used. The study involved a WebCT conference for a total population of 123 second year undergraduate students following a module on Communicating via Multimedia. Students were split into groups of 3-6 students. There were about 1500 contributions to the debates over 10 days. One result was that 70% of students stated that the approach taken was successful at getting them involved in critical debate (the 1999 score for the same question was 56%). Another result was that women read about 11% more items than men and men posted about 6% more items than women. Furthermore, women were under-represented in the top 20% of overall module grades and over-represented in the module fails. The paper explores these issues.

Keywords
critical thinking, gender and technology, multimedia education

Introduction

This paper presents some preliminary findings from a study of online debate for multimedia students. The study had various aims. The module tutor's aim, the first author, was to conduct research into the process of facilitating online debate, i.e. skills in articulating and debating ideas and development of skills in communication. The research team's aims, i.e. all of the authors, were to provide an external view on the online debates and to investigate issues related to gender and online learning.

We start from the position that both gender and computing are socially constructed. A considerable amount of research has pointed to gender differences in computer use, with some earlier work suggesting that the problem lies with women. Chen (1986) for example, suggested that "the main obstacle to a higher level of female interest lies in the willingness to engage in such experiences more frequently" (Chen, 1986; p. 275). In contrast, a number of feminist researchers have demonstrated how the history and construction of computers is gendered, and has been dominated by Western men (Janson, 1989; Sofia, 1993), with a masculinist influence evident in more recent developments in artificial intelligence and virtual reality (Adams, 1998; Balsamo, 1997). Gender differences have also been identified in online communication, with men tending to post more than women, and dominating online discussions (Hall, 1996; Herring, 1994; Herring, 1996; Stewart, Shields, Monolescu & Taylor, 1999). Spender (1995) noted that there is a risk that men will dominate this new technology just as they did the printing press (Spender, 1995), and indeed the number of women studying traditional computing courses in the UK has dropped significantly in recent years (Clegg & Trayhurn, 1999). There are, of course, considerable differences in computer use *within* genders as well as between them, but the evidence does suggest an on-going problem with the ways in which computers, computing culture and computer education continue to be defined as areas of masculine dominance and expertise. As Clegg and Trayhurn argue, we need "to ask what is wrong with computing rather than what is wrong with women" (1999; p. 75). It is in this spirit that we approached research on this module.

The paper is structured as follows. In the next section we describe the research methods used in our study and in Section 3 we describe the study set up. In Section 4 we present the results, which are then discussed in Section 5. Section 6 briefly concludes the paper.

Research Methods

A number of research methods were used, which are outlined below. The project made use of a mixture of quantitative and qualitative methods. This mixture of methods provides summary numerical data supported by richer insights based on discussion (England & Finney, 1999; Atkins, 1993). The methodological approach taken could be seen to stem from the teacher as action researcher model (see Stenhouse, 1975) building on reflective pedagogic practice to a more explicit research strategy. The tutor took responsibility for evaluating his own module, with the assistance of the other authors, to provide different perspectives and a more robust analysis. Methods used included asking students about their initial expectations of the module, analysis of online conferencing, and a post-module questionnaire. Attempts to set up post-module focus groups to explore the gender issues that emerged were not, unfortunately, successful. The modular system, along with students' work and family commitments, have proved significant obstacles to engaging students with research activities outside class time.

The post module questionnaire was administered to students in the last week of their study. The questions usually used a scale from 1 to 4, where 1 indicates 'very poor' and 4 indicates 'very good'. Space was left after each question for additional comments by the student. Different sections asked participants for data related to the module web based study resources, the online critical debate and gender/age. Each student was asked to fill in the questionnaire and was informed that: (i) the results would be used to improve the module online resources for next year's students and to help with some research, (ii) their identity in the reporting of the research will not be revealed, and (iii) that by filling in the questionnaire they were agreeing to take part in the research.

A spreadsheet was complied with the following data for each student: grades, gender and online participation data (items read/items posted). It was possible to gain a high degree of accuracy, in terms of the amount of access to the discussion group, because WebCT provides data on the number of 'hits' and 'posts' for each student. Because all other course web pages were kept outside the WebCT environment these figures (given below) hence related to the use of the conferencing facility. That is to say, precise data on the number of discussion area readings and postings was automatically collected by WebCT for each student.

The Study

The study involved 123 second year undergraduate students. These students were following a module on 'Communicating via Multimedia'. Participants in the module were involved in assessed online discussion groups that aimed to foster a 'community in inquiry' (Lipman, 1991) and provide an opportunity for vicarious learning (McKendree, Stenning, Mayes, Lee & Cox, 1998). A community of inquiry is teacher-guided; it places an emphasis on social interaction and co-operative learning, and it involves reasoning and judgement about knowledge. The starting assumption for vicarious learning is that much real learning occurs through observation of other learners engaged in active dialogues.

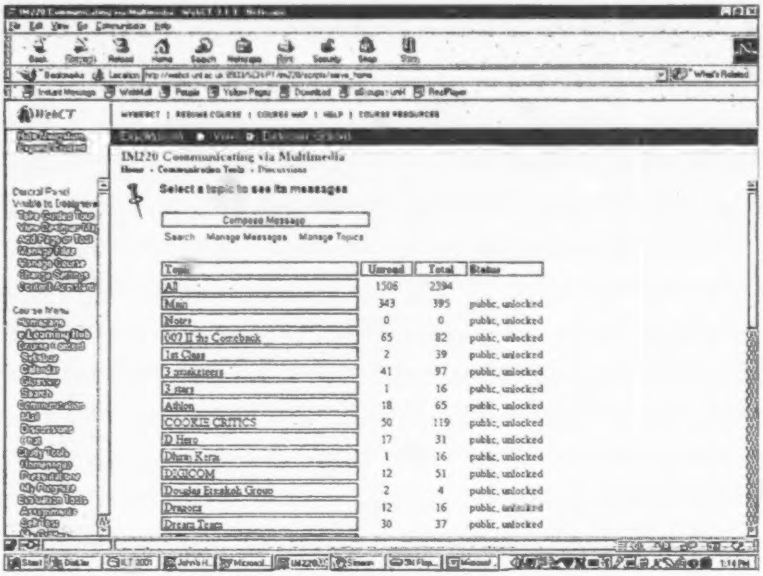
On the module under study students had to complete two assessment tasks, each carrying equal weighting; there was no exam. The focus of this paper is assignment one, which involved groups of students co-operating to devise and apply criteria for website evaluation. We were particularly keen to design the interactions with students on the module in such a way that would promote critical debate about the assessment task. The learning that the assessment one was trying to foster was critical thinking and argument. Assignment two had as a learning outcome a critical evaluation task, so this first assignment was also preparing students for this.

A live debate relating to the assignment would not, in the first author's view, have taken place if students were not motivated in some way. Consequently, the marking scheme for the assignment included 60% for group work and 40% for individual work. The individual marks were to be allocated as follows:

Individual contributions (to online debate)
20% ability to answer questions
20% taking a lead in the discussion, showing awareness of the issues.

Students were asked to make at least three postings to the online debate. The central focus in this study was thus the development of discussion and debating skills, and the assessment reflected this target.

The study involved a WebCT conference where students were split into groups of 3-6. A screen-shot of the group discussion areas for the module is shown in Figure 1.


WebCT
MYWEBCT | RESUME COURSE | COURSE MAP | HELP | COURSE RESOURCES
Compose Message
Search
Manage Messages
Manage Topics

IM220 Communicating via Multimedia
Home • Communication Tools • Discussions

Select a topic to see its messages

Topic	Unread	Total	Status
All	1506	2394	
Main	343	395	public, unlocked
Notes	0	0	public, unlocked
007 II the Comeback	65	82	public, unlocked
1st Class	2	39	public, unlocked
3 muskateers	41	97	public, unlocked
3 stars	1	16	public, unlocked
Athlon	18	65	public, unlocked
COOKIE CRITICS	50	119	public, unlocked
D Hero	17	31	public, unlocked
Dhara Kera	1	16	public, unlocked
DIGICOM	12	51	public, unlocked
Douglas Etrakoh Group	2	4	public, unlocked
Dragons	12	16	public, unlocked
Dream Team	30	37	public, unlocked

Figure 1: WebCT group conference area for online debate

There were about 1500 contributions to the debates over 10 days. The module tutor and 3 tutorial assistants were involved in the debate. Of the tutors teaching on the module three were men and

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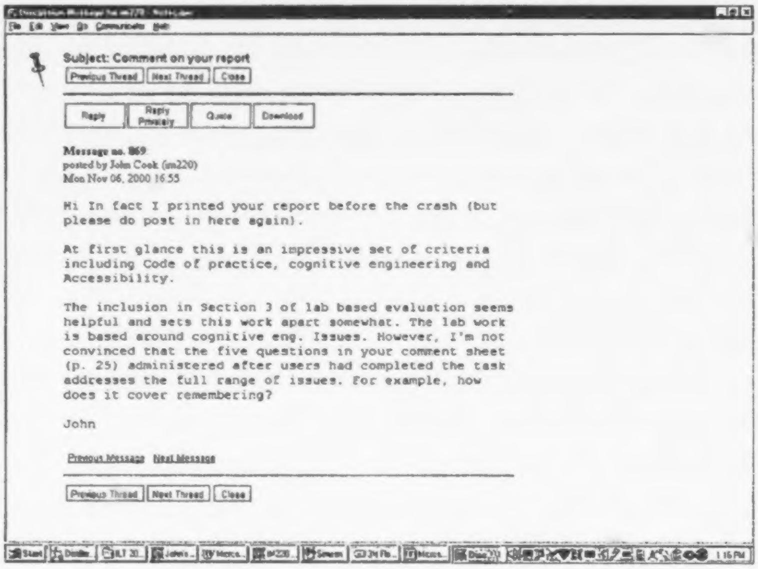
one was a women. In total there were 29 women and 94 men participating in the module. Thus 24% of the cohort were women (just under a quarter). Some example dialogues from the previous year's cohort were put on the module website in order to provide a vicarious learning resource.

Figure 2 shows an example intervention by the tutor into one of the group's debate.


Subject: Comment on your report
Previous Thread
Next Thread
Close
Reply
Reply Privately
Quote
Download
Previous Message
Next Message
Previous Thread
Next Thread
Close

Message no. 869
posted by John Cook (im220)
Mon Nov 06, 2000 16:55

Hi In fact I printed your report before the crash (but please do post in here again).

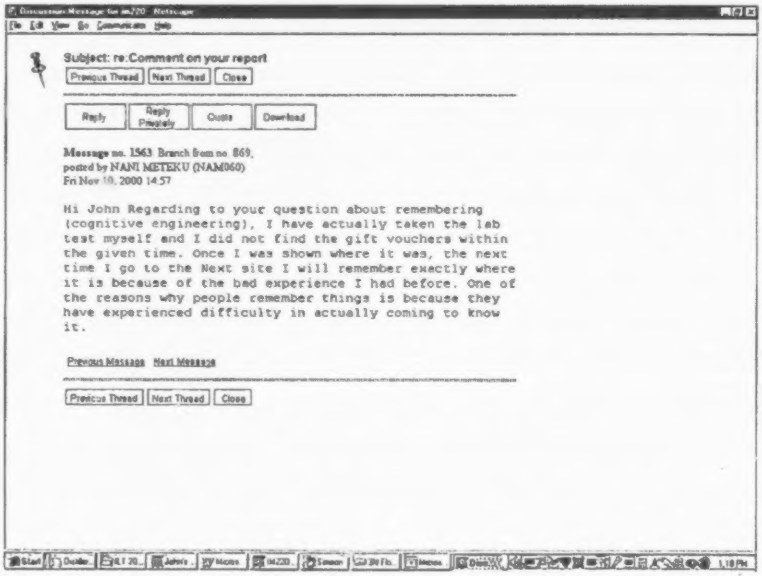
At first glance this is an impressive set of criteria including Code of practice, cognitive engineering and Accessibility.

The inclusion in Section 3 of lab based evaluation seems helpful and sets this work apart somewhat. The lab work is based around cognitive eng. Issues. However, I'm not convinced that the five questions in your comment sheet (p. 25) administered after users had completed the task addresses the full range of issues. For example, how does it cover remembering?

John

Figure 2: Example tutor intervention from online debate

Figure 3 shows the one student's response to the intervention shown in Figure 2. As can be seen the debate included some interesting open-ended discussion. The student's name has been blanked out in Figure 3 in order to preserve the participant's anonymity.


Subject: re:Comment on your report
Previous Thread
Next Thread
Close
Reply
Reply Privately
Quote
Download
Previous Message
Next Message
Previous Thread
Next Thread
Close

Message no. 1563 Branch from no. 869,
posted by NANI METEKU (NAM060)
Fri Nov 10, 2000 14:57

Hi John Regarding to your question about remembering (cognitive engineering), I have actually taken the lab test myself and I did not find the gift vouchers within the given time. Once I was shown where it was, the next time I go to the Next site I will remember exactly where it is because of the bad experience I had before. One of the reasons why people remember things is because they have experienced difficulty in actually coming to know it.

Figure 3: Example student response

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The tutor predicted that he would be able to build on the previous year's experience (Boyle & Cook, 2001) in order to improve the online debate. Below are extracts from an email that was sent by the first author to the other course tutors in an attempt to 'prepare' them for the debate.

> Dear IM220 teaching team,
> The big debate starts Monday 6th November and ends Friday
> 10th at 5 pm. I have set up all the groups with a discussion area. Don't come into the labs for week 7&8. That means I'm freeing up 4 hours of your time to do the debate in your own time. Please, please don't get ill next week, I really want to pull this one off ;-)
>
> Here are some guidelines for you:
> 1. Read reports asap on Monday and post messages asap.
> 2. John and Stella focus on these groups:
> *[list of 11 groups given]*
>
> Fred and Martin to focus on these groups:
> *[list of 12 groups given]*
>
> But feel free to join in the other groups if you have time :-)
>
> 3. Fred and John to do targeting tactics: i.e. tracking students in a group with low postings.
> 4. Please try and mix your postings between short sharp replies and more reflective posting.
> 5. Remember, students can reply to our questions and take a lead in the debate.
> 6. In this critical debate be on the lookout for evidence. This is like a court of law, if an assertion is made we need evidence. HOWEVER, there is room for creativity and passion and enthusiasm.
> 7. Each pair to mark the group report out of 30 marks and individual input to debate out of 20 marks. I have attached the Assignment 1 Group Work marking sheet. For the individual component give marks as follows: 10 marks ability to answer questions and 10 marks for taking a lead in the discussion, showing awareness of the issues.
>
> Ask me if you get stuck or have tips to share
> Good luck
> John

The students were given briefings similar to point 6 above in lectures. Furthermore, the research team predicted that, based on the current evidence already cited, there would be gender differences in online participation, with men likely to post more than women.

Results

The first activity undertaken by the module tutor was to ascertain students' own expectations about the module, and what they want to get out of it. This took the form of an online exercise in week 2. Students communicated online about their expectations/desired outcomes from the module. A preliminary analysis of the data has shown that students typically expressed their views on what they expected to get out of the module in terms of the subject area and not in terms of generic skills.

The next step was to ascertain the effectiveness of teaching, learning and assessment activities in relation to the critical debate skills during the module. This was evaluated in two ways: the questionnaire asked specific questions on these points and the rest of the study team (the second and third authors) were asked for an opinion on the critical debate skills displayed by students during the module online debate. The questionnaire provided an indicator which showed that the module has improved on last years performance: 70% of students stated that the approach taken was successful in getting them involved in critical debate (the 1999 score (Boyle & Cook, 2001) on same question was 56%). The members of the study team, who were not involved in the delivery of the module, commented on the critical debate. Their observations are contained in the next paragraph.

As will be seen, gender differences in numbers of postings were evident, with women making fewer postings, proportionately, than men. Most of the students, both women and men, made reasoned and thoughtful contributions to the debate. The most successful debates were those where all group members stated their appreciation of, and/or support for, others' comments before going on to add their own contributions. There were, however, some adversarial or hostile postings, and these were all by men. The postings by women tended to ignore these hostilities, and/or were conciliatory, as were some men. There does, therefore, seem to be some evidence here for the gender differences in styles of postings that have been noted elsewhere (Hall, 1996; Herring, 1994; Herring, 1996; Stewart et. al, 1999).

Tables 1 and 2 show response scores to the first two sections of the questionnaire. Out of the 123 students on the module 60 completed the post module questionnaire. Percentages have been rounded to the nearest whole number. Each response score is expressed as a percentage of the sample response. Thus male responses are expressed as a percentage of 38; women responses are expressed as a percentage of 14. Note that 8 respondents to the questionnaire did not specify their gender and have hence been excluded from Tables 1 and 2.

Question Category	**Men (%)**				**Women (%)**			
	very poor	*poor*	*good*	*very good*	*very poor*	*poor*	*good*	*very good*
Website Navigation	3	26	63	8	0	7	50	43
Website Presentation	5	24	68	3	0	21	50	29
Web-based Support Materials	0	32	57	11	0	29	42	29
Notice Board Rating	3	39	45	13	21	14	36	29
FAQ Rating	0	42	40	18	7	7	50	36
Usefulness of Module Website	0	19	62	19	0	14	57	29
Access to other websites	0	24	70	6	0	21	57	22

Table 1: Website rating

Table 1 summarises the response to the first part of the questionnaire. This part of the questionnaire asked seven questions that related to the various web-based resources made available to students. Table 2 summarises the response to the second part of the questionnaire. This part of the questionnaire asked four questions that related to the online critical debate that students engaged in for assignment 1.

Question Category	**Men (%)**				**Women (%)**			
	very poor	*poor*	*good*	*very good*	*very poor*	*poor*	*good*	*very good*
Contribution to Critical Debate	0	30	51	19	0	14	57	29
Critical debate Rating	3	8	57	32	0	7	50	43
Success of Critical Debate	6	11	64	19	0	7	57	37
Readability of Debate	0	32	44	24	7	21	57	13

Table 2: Online critical debate rating

Table 3 shows the average number of items read and posted by gender. As we point out above, it was possible to gain this accuracy because WebCT provides data on the number of 'hits' and 'posts' for each student. If we express these figures as a proportion of the population (i.e. 29 women and 94 men), then women read 10.9% more items than men and men post 6.25% more items than women. These figures were derived as follows. Averages = total posted/read for gender type ÷ total population for gender type. Average items read by women = 10321 ÷ 29 = 356, average items read by men = 26837 ÷ 94 = 286. Average items posted by women = 432 ÷ 29 = 15, average items posted by men = 1600 ÷ 94 = 17. These calculations are represented in Table 3.The difference in reading hence = (356 +285) 642 = 10.9 %. The difference in posting = (17 +15) 32 = 6.25 %.

The following questions now arise: What would be a statistically significant difference? What is the quality of the submissions, rather than quantity? (do women put in fewer, but longer well considered contributions?) The answer to the first question is that there is a significant difference in that 10.9% women read more men. The answer to the second question will require further research and is beyond the scope of the report of preliminary results; however, below we make some initial observations.

	Items Read	**Items Posted**
Women	356	15
Men	286	17

Table 3: Average reading and posting by gender

Another result was that women were under-represented in the top grades and were over-represented in the fails. We would expect 6 women in the top 20% (i.e. the top 24 students), however we get 4. Also, 8 students failed. We would expect 2 women to fail but we get 4. However, if we only look at womens' grades for the first assignment (i.e. the group report and the online debate) then women do better: we get 7 women in the top 20% and 3 women fails. Caution must be expressed about these pass and fail rates for women given the variability of the 'distribution' that is applicable to a small cohort. However, given this reservation, a tentative result was that the online debate acted in favor of women students, i.e. it boosted womens' grades for the first coursework in comparison to womens' grades overall.

Discussion

It is important to note that the small numbers in this preliminary set of findings have implications and limitations for our interpretations. However, taken at face value the module produced 70% satisfaction rating with respect to approach taken to getting the students involved in critical debate. This represents a 14% improvement on the previous years rating. This success can be put down to better briefings given by the module tutor to the tutorial assistants about how to cope with the heavy load in terms of postings in the 10 day critical debate period. Another result was that, if we examine Table 1 and 2, we find that women are more ready to give positive assessments of the Website and online critical debate.

The gender differences in overall grade scores for the module were, however, worrying. The trend nationally is for women to outperform men at university, with women home students in the UK now getting more first class honours degrees than men, and 59% of upper second class honours results go to women. In contrast, men get 61% of the third class/pass degrees (HESA, 1998/99). However, the overall results for this module appear to reverse this trend. Even more worrying is the over-representation of women in the fail category.

The reasons for these gender differences in students' results are not made clear by this study. More research into women students' perceptions and experiences of the module is called for. In particular, single sex focus groups exploring students' computing background, reasons for choosing the subject/module, their aims and ambitions, and their experiences and preferences during the module would enable us to make more sense of the quantitative data about online participation and differential grades than has been possible in this study.

Although in the post-module questionnaire we asked about access to a computer at home, more in-depth qualitative work would help to articulate the quality and frequency of this access. Other research has suggested that access to home technology remains gendered in favour of men and boys (Gray, 1992; Millard, 1997), and it would be interesting to discover whether this is the case for computing students. This is just one of the issues that may be of interest in attempting to explain gender differences in the results. Of greater significance, however, is likely to be gendered aspects of curriculum content and delivery as well as the wider context (a school of computer science) in which the course is located. For example, only one of the four module tutors was a woman; and she was a junior member of the team (an M.Phil. student taking on part-time teaching). This may have reinforced the perception that computing is a male dominated subject area. Further research is needed to investigate these issues.

Conclusions

The module appears to have been successful overall in involving students in critical debate. The gender differences identified, however, remain a serious cause for concern. Work currently in progress, see Appendix, has examined two University of North London computing modules for the academic year 1999/2000, see Table 4 in the Appendix. The two modules examined were Communicating via Multimedia (again, see Table 5 in the Appendix) and Software Engineering for Computer Science (see Table 6 in the Appendix). We have found that for these two modules the UK national trend in 1999/2000 for women to get less first class honours than men is not replicated; for the two modules examined women did better than men in the first class category. However, for these two modules women were over represented in the unclassified results. We feel that these additional finding require further work to examine ways of enhancing the achievement of women.

As we point out in the introduction, this paper reports some preliminary results. Consequently, future work will revolve around the following three areas.

- We still need to answer the question posed in the paper: "What is wrong with computing rather than what is wrong with women?"
- Improving the experiment design. Monitoring gender is only one of the many factors that might affect this complex learning situation. We will consider generating some alternative hypotheses for testing.
  - Create gender-free identifications for the students (to rule out expectation-driven behaviour). For example we could consider other random groupings of students' race, age, hair colour, whatever, to see if the effect happens across other dichotomies.
  - Analyse for a variety of other possible contributing factors, for example previous grades or academic experience, experience with computers, etc., to see if these explain the effect.
- Include more questions to elicit open-ended comments to enlightened the authors about other factors influencing both the submissions (quality/quantity) and the reading time (quality/quantity)

Funding is currently being sought to address some the above issues in a new study.

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Appendix

Table 4 is UK national data on degree classification with each gender expressed as a percentage of population for the relevant gender. Tables 5 and 6 are for University of North London computing modules for the same year as the HESA data, i.e. 1999/2000.

	Gender	
Class of degree	**Women**	**Men**
First class honours	8.71	10.57
Upper second honours	36.10	32.84
Lower second honours	36.10	36.36
Third/Pass	12.45	13.98
Unclassified	6.22	6.25

Table 4: 1999/2000 UK national statistics for computer science showing degree classification by gender (source HESA, 1998/99) (Women = 2410, men = 8800)

	Gender	
Class of degree	**Women**	**Men**
First class honours	10.34	15.96
Upper second honours	37.93	35.11
Lower second honours	34.48	34.04
Third/Pass	3.45	10.64
Unclassified	13.79	4.26

Table 5: 1999/2000 Communicating via multimedia module (results showing degree classification by gender, women = 29, men = 94)

	Gender	
Class of degree	**Women**	**Men**
First class honours	11.11	1.39
Upper second honours	22.22	9.72
Lower second honours	5.56	20.83
Third/Pass	16.67	31.94
Unclassified	44.44	36.11

Table 6: 1999/2000 Software engineering for computer science module (results showing degree classification by gender, women = 18, men = 72)

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FROM DEPENDENCY TOWARDS SELF DIRECTION VIA VIRTUAL CHAT: THE CASE OF ONE TAFE CLASS

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Abstract

The quality of online interaction via computer-mediated communication that might enable the collaborative construction of knowledge can be seen in terms of the ability of students to operate effectively in the medium. However, even when the communicative technical skills are sufficiently in place, there are the virtual dynamics to consider. Even the most technologically capable communicators may be students, accustomed to being teacher dependent, and possibly reluctant to take up the responsibility for the task of learning. The importance of the role of the E-moderator is often stressed, especially in synchronous chat, to enable constructive discussion to occur but in a manner that invites students to take self-responsibility. This study of TAFE students using virtual chat in an online campus-based course, traces their development, with the help of their online facilitator, from dependency towards self-direction.

Keywords

social interaction, virtual chat, group dynamics, online moderator

Introduction

With the convergence of communication and information technologies many "educators are wondering whether the online format will provide adequate support for genuine dialogue and social interaction, vital elements in the learning process" (Hobaugh, 1997, cited in Muirhead, 2000a, p. 1). Stacey (1998), Treleaven, Cecez-Kecmanovic & Wright (2000), Wegerif (1998) and Curtis (1999) are positive about the potential for collaborative construction of knowledge through social interaction via web technologies such as threaded discussion, virtual chat and email. Stacey (1998) outlines the importance of collaborative behaviour in computer-mediated communication (CMC) to support group learning or the need to have social presence if the cognitive is to be sustained (Garrison, 1996, cited in Stacey, 1999, p.28). This paper looks at the dynamics that affect the learning in an online non-distance course where students are required to communicate using the chat facility in the Classroom, within RMIT's Distributed Learning System. It links social constructivist learning theory with the psycho-social theory or Tavistock School of group relations.

The ability to construct knowledge via social interaction over the web requires particular "kinds of communicative and technical capabilities" (Hara & Kling, 2000, p.1). These have been identified by Rowntree (cited in Muirhead, 2000b) as good computer skills, a level of online literacy and discussion, time management and interactive skills. From the initial survey the students in this study were found, although new to chat, to have sufficiently developed skills to be able to operate well enough in this medium: all students for example were excellent touch typists. Rather it was the dynamics around the teacher and online facilitator that was found to be of significance in terms of learning. Similarly the purpose of communicating in synchronous chat, while not the imperative of distance education students, was found to be sufficiently authentic (Stacey, 1998). Technical reliability, although a factor was also 'good enough' for the purposes of the study.

Collaborative Learning in Cyberspace

The behaviour or dynamics of a group (Bion, 1961) can exist virtually. Jacques, 1992, (cited in Stacey, 1998, p.13) suggests that "the sense of the group exists even when members are not collected in the same place." The dynamics of virtual groups suggest the degree to which students are able to be mature psychologically (Klein, 1959) and therefore display behaviour that is capable of sustaining adult learning. Or to use Bion's (1961) thesis; whether the group can operate as a work group and focus on the task or whether it functions defensively from one of three basic assumptions, fight/flight, dependency or pairing. It is suggested that cyberspace can be thought of as Winnicott's (1971) potential place, where the creative play of a child occurs in the presence of m/other. Suggested also is the possibility that deep learning may occur in this virtual space, where the m/other might be the E-moderator.

The Importance of the E-moderator in Cyberspace

Muirhead (2000b) suggests that educators play a vital role in promoting consistent and relevant interaction between students and tutors. Salmon (2000, p.46) asserts the importance of the E-moderator in synchronous learning networks "to avert chaos." This role is summarised as the ability to give good clear structure to the session, to clarify objectives, roles of participation as well as ensuring participation by all parts.

Similarly a Tavistock facilitator manages the time, task and territory, thus encouraging participants to take-up their full authority. Rather than to operate defensively from basic assumptions and in particular Basic Assumption Dependency, where the group is dependent upon the teacher and unable to take full responsibility for its learning (Bion, 1961).

The Study and its Design

This ethnographic study is of a TAFE class of twenty students who participated in virtual chats in Semester 2, 2000, as part of one of three online subjects studied mainly on-campus, namely DM425 Project Management.

The study was designed to carry out a "social anthropological evaluation" (Parlett & Hamilton, 1972) taking in a student perspective to illuminate and explore problems, features and issues. The focus was on the psycho-dynamic or underlying issues behind students' online textual interaction. Discussion logs and interview transcripts were analysed using Schein's (1990) three tiered model of culture comprising artefacts, norms, values and assumptions.

A case study methodology was used to develop a "thick description" (Geertz, 1973) of student chats comprising as follows: firstly in the computer labs, three whole class chats and those between each of four syndicate groups. Secondly, there were two whole class chats from remote locations. While the E-moderator chose the discussion questions for the whole class chats, the syndicates chose their discussion questions. Chats were observed wherever possible by the researcher who also followed-up with an interview. Data also included the initial survey mentioned above concerning online experience, an interview with the E-moderator, and a whole class focus group.

DM425 and Research Setting

The TAFE students knew the E-moderator well from previous face-to-face classes and continued to enjoy such contact in DM425: they praised her for returning their emails "like a Mum." The E-moderator says that she had actively been working against this Basic Assumption Dependency (Bion, 1961), seeing her role very much as "supporting students in (their own) learning." Student centred online learning materials direct students through various stages of managing a project.

Analysis and Discussion of Online Dynamics

For the purposes of the analysis, students are nominated by their initial and time, in terms of hours, minutes and seconds in which they posted.

On face value, it might seem that some of the key requirements identified above by Salmon (2000) for the E-moderator were not adequately met. The first three whole class sessions are virtually 'chaos' with no apparent logical discussion or learning about content. However, for the E-moderator these sessions met her objectives of student familiarisation with the chat facility.

Several of the key issues raised by students in the final focus group, important questions not being answered and lack of clarification (also raised by E 01:11:35 on Oct 9) however are related to deliberate ploys by the E-moderator to assist the students in taking responsibility for their own learning. Some examples are given to demonstrate.

In the Aug 28 syndicate *Chuppa Chops* session, the E-moderator deliberately does not participate, although logged on, until half way through the session. Here the group appear to collaborate quite effectively on the component parts of the final project management report. The E-moderator, however, had "gone through this with them in class over and over" for the previous three semesters and thought it was now "up to them." Therefore she 'ignores'
B: Are you sure, they don't go in the appendices?
F: Dp(o) you put that in the ana(l)yli ()sis? adding instead
You must also review your project costs.

In the *Virgomania* syndicate session on the same day L is apparently left asking whether her project can be hypothetical. M continues to complain about not having time to contact key people. As the E-moderator explains, L and she had discussed endlessly the possibilities to do with her (L's) project face-to-face: M can be seen to be projecting (Klein, 1959) her inability to make adequate time for her project. The group continues to "fool around." They evade the real issues and continue to question whether costings, their choice of discussion question, is what they were supposed to be talking about. The E-moderator's response is to subtly admonish the group:

> 01.15.52 These chats are aimed at helping students clarify any points eg costings. If we were at remote locations, you would not be able to speak to one another.

This however seems to have little effect on the group who continue to evade discussing project costings. N logs off because the chat is "crap" and she has had "only one question answered." It seems that the group, including L and M, are not able to help N with her costings because their energy is taken up in Basic Assumption Dependency functioning (Bion, 1961).

The first whole class remote chat on Sep 4 is spent defending against the anxiety of completing their projects (Menzies, 1970). The whole time is spent talking about what needs to be done and why they are unable to do it. Here it is clearly a case of the collective group fear about the assessment preventing any collaboration online that could lead to learning. The dependent group appear to be working from the assumption, that if only 'Mum' could look after them properly, they would not have to face up to what in fact they need to do.

Interestingly, it is only when the group has taken responsibility for completing their project reports that they can make use of the October 9's remote and final chat whole class session. Here there is a valuable and mature discussion on the group's experience of online chat. This is the only session where the quality of interaction enables the task or discussion question to be consistently carried, as if with a natural ability at all the factors outlined above by Rowntree (1995 cited in Muirhead, 2000b). The discussion is literate, with students reading and responding critically to one another's messages. Time is managed well with most participating effectively under the E-moderator's facilitation. Finally the students also demonstrate the 'net etiquette' or quality of interacting that shows respect for others.

Conclusion

Concerns with the quality of online interaction suggest that the virtual environment may be an inhibitor to learning. However the online dynamics in this study suggest rather, that DM425 students were only able to socially construct knowledge, demonstrating their pre-existing "communicative and technical capabilities (Hara & Kling, 2000, p.1) when, as with face-to-face teaching, they had finally taken responsibility for the task of completing their individual projects. The role of any facilitator, virtual or online, is crucial to such development. Even if the students have the requisite skills to operate effectively in the virtual environment, they still need to move from dependency on the E-moderator so they can become genuinely self-directed in the their learning.

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PROJECT DESIGN AND ACHIEVING EDUCATIONAL CHANGE: FROM STATPLAY TO ESCI

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Abstract

Educational Design encompasses many aspects of educational software development, but needs to be extended to Project Design (PD) by inclusion of a strategy for dissemination. This crucial aspect of PD should be considered from the start, and usually involves commercialisation. Models for commercialisation are diverse, and the choice can have enormous implications for many aspects of the project and for its chances of success. The case for PD is illustrated by a brief account of StatPlay, a large multimedia project for learning of statistical concepts that was largely successful educationally but failed to achieve commercialisation. The more modest PD of ESCI (Exploratory software for confidence intervals) is also outlined. Taking commercialisation seriously should lead to policy changes by universities and funding bodies, and should include increased attention to intellectual property issues, and the provision of professional support for aspects of commercialisation. Formulating a comprehensive PD from the start, and attending to commercialisation issues throughout, should yield more successful projects.

Keywords

project design, educational software, learning statistics, commercialisation, project management, educational innovation

Introduction

It is notoriously difficult to achieve widespread educational innovation. Even if a local trial gives evidence of educational effectiveness, it is *very* hard to achieve wide take-up. Fullan and Stiegelbauer (1991) described attitudinal, institutional and cultural obstacles to successful spread of educational change. Teachers are too busy, established practices too entrenched, and the shiny-eyed innovator too easily dismissed as a biased enthusiast. To make a worthwhile difference to the world an innovation must be educationally effective, but must also have a realistic and powerful mechanism for proliferation.

Educational computing has innumerable tales of local trials that elicit enthusiasm and are pronounced effective, but are not taken up elsewhere. In this paper I propose that *Educational Design* (Cumming, Finch & Thomason, 1999) must be extended to *Project Design* (PD). The critical feature of PD is that plans for proliferation—which usually requires commercialisation—are integrated into the project from an early stage.

StatPlay was a multimedia project that during 1994-99 developed materials for statistics learning. From the start we worked towards taking StatPlay to the world but, despite great classroom success, we did not achieve commercialisation. I will give a brief account of StatPlay and identify some lessons for the PD of educational software.

ESCI (pronounced "esky"; Exploratory software for confidence intervals) is my recent, more modest project aimed at improving the visual interpretation of confidence intervals (CIs) and promoting their use. Like StatPlay, its general goal is to improve statistics understanding, but its scope is narrower. Its design (Cumming & Finch, 2001), including the strategy for proliferation, reflects lessons from the StatPlay experience, especially the StatPlay difficulties with intellectual property (IP) and the numerous steps necessary to achieve large-scale commercialisation. I will introduce ESCI, outline its PD, then suggest some overall conclusions about PD that may assist more projects to develop to the stage that the software and materials they produce are actually used more widely.

StatPlay: Multimedia for Understanding Statistical Concepts

After decades of advocacy by reformers it is now likely that statistical practice in psychology may at last change for the better (Finch, Cumming & Thomason, 2001; Wilkinson & Task Force on Statistical Inference, 1999), although rapid progress is certainly not assured (Finch, Thomason, & Cumming, in press). One obstacle to reform has been widespread and well-documented misconceptions about some core statistical concepts. Improved statistical understanding is required if reform is to succeed.

In 1993 Neil Thomason and I (the 'principals') conceived the notion of StatPlay. Thomason, Cumming and Zangari (1994) described its design rationale. The goal was deep understanding of basic concepts, as a contribution to statistical education and reform. StatPlay would present vivid graphical representations and invite students to regard these as 'take-home' visual images to serve as anchors for understanding. Multiple representations (including perhaps images, graphs, numbers, and formulas) would be offered, whenever possible linked together dynamically on the screen. The whole would be highly interactive, and invite exploration of target concepts.

StatPlay Classic

We considered carefully how to build StatPlay. We weighed up Hypercard, Authorware, Director, and Visual Basic. We carried out trials, and sought expert advice. We eventually chose Visual C++ as being necessary to achieve excellence of interface design, together with smooth, immediate interactivity. The disadvantage was that it is a full programming language—not an authoring environment—and so we could not build software ourselves, but would have to raise grants and employ software developers.

During 1994-1997 the first version of StatPlay, now known as StatPlay Classic (Figure 1), was built, largely by Mark Zangari and Jan Les. Classic ran under the 16-bit Windows 3.1. Successive versions were used at La Trobe University and the University of Melbourne. Classroom reception was good and controlled evaluations gave evidence of effectiveness (Cumming & Thomason, 1995; Cumming, Thomason, Howard, Les & Zangari, 1995).

An important development was the multimedia recording and playback facility Sam (as in 'Play it again…'), which gave learners access to an extensive set of 'demos' (Les, Thomason & Cumming, 1997; Les, Cumming, Thomason & Finch, 1997). Sam allowed easy recording of a demo—any brief interaction with StatPlay, with voice commentary—then a learner could play back any chosen demo to hear and see an explanation or example, perhaps with guidance for the learner's next challenge. Sam demos were especially enthusiastically received in the classroom. Demos could be used to build a whole curriculum; Sam could also be used by students or tutors to record demos to express their understanding, or to pose a question.

StatPlay Classic has been used, since 1994 and currently at La Trobe, and since 1996 at the University of Melbourne. In 1997-98 it was used at Melbourne by more than 3,000 students each year in more than a dozen departments, and some unsupported use continues. It is also used by colleagues in a small number of other universities, with dissemination limited by StatPlay's uncompleted state and our inability to offer support.

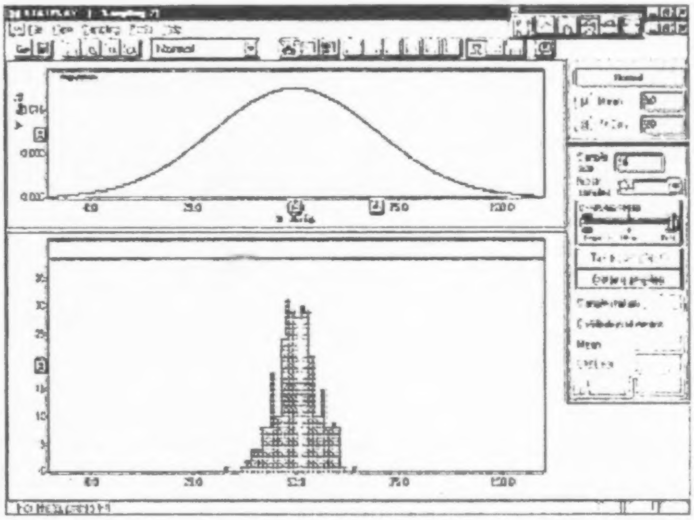

Figure 1: The Sampling Playground of StatPlay Classic. The 'mean heap' (below) is the distribution of means of many independent samples from the population (above). Many aspects of the simulation are under user control. The standard error (SE) is easily seen and remembered as the standard deviation of the lower distribution. The Central Limit Theorem can be explored by drawing a population of any desired shape in the upper panel: The lower distribution remains approximately normal in shape.

StatPlay 1.0

We wanted a better, cleaner interface but realised that building our own would require more programming effort. In 1997 we had an important choice: We could work further on StatPlay Classic and seek its commercialisation as a first-version product that would cover important parts of a foundation statistics course, but far from a whole course. Alternatively, as part of upgrading to 32-bit Windows 95, we could start again more or less from scratch, design and build a much-improved interface and work towards 'StatPlay 1.0' having wider coverage of concepts. After careful weighing of pros and cons we chose the ambitious course: We left the usable but incomplete Classic and started work on version 1.0.

In 1997 Jack Zhang joined as software developer, and Robert Maillardet as part-time designer and manager. Sue Finch worked on specifications, classroom materials and research. We had three full-time software developers; seven people attended team meetings. We formalised the development of comprehensive written specifications, and the management of software development, with weekly reviews of progress against the detailed plans. These arrangements were very effective and great progress was made during 1997-98. Figure 2 shows the clean, spare style of our interface of 1.0.

Funding

StatPlay was funded mainly by five CAUT-CUTSD grants (1994-99) and by multimedia development grants from the University of Melbourne (1997-99). There was a joint Melbourne-Monash grant in 1999, and consultancy income of the principals was also used. The total was about A$650,000—not including principals' time. In addition ARC funding supported closely related research (1996-2001). About 8 person years of software development, and 7 person years (including principals' time) of design, specification, management, materials development, classroom work, and numerous other tasks, went into StatPlay.

An enormous amount of time went into efforts to find funding. A consequence of piecemeal funding was that we always had to propose new developments, when what StatPlay really needed

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was careful testing and revision to produce a robust version we could promote to the world. It is a *very* long road from a wonderful prototype to a rounded-out, robust, tested, refined and fully documented product accompanied by proven learning materials!

Intellectual Property

In mid-1997 La Trobe and Melbourne Universities agreed to assign the IP in StatPlay to the principals, with reasonable conditions. In the case of Melbourne this required of us 15 months of work, as the University's IP administration and policy were in a state of flux. In 1997-98 we submitted a provisional patent application (with support from the University of Melbourne) for the Sam multimedia utility, and spent much time and effort seeking—without success—a commercial partner to exploit Sam's techniques, hoping this would finance further development of StatPlay.

We were nervous about the IP aspects of CAUT-CUTSD grants, as the rules changed from year to year and were poorly worded. However our biggest IP problem was raised by the 1999 Melbourne-Monash grant, for which Kevin Korb joined us as a StatPlay principal. The project was delayed by the 6 months it took to achieve an IP agreement and even then there was no assignment, only a commitment to assign at completion of the project. (By September 2001 we have still not been able to finalise this assignment.)

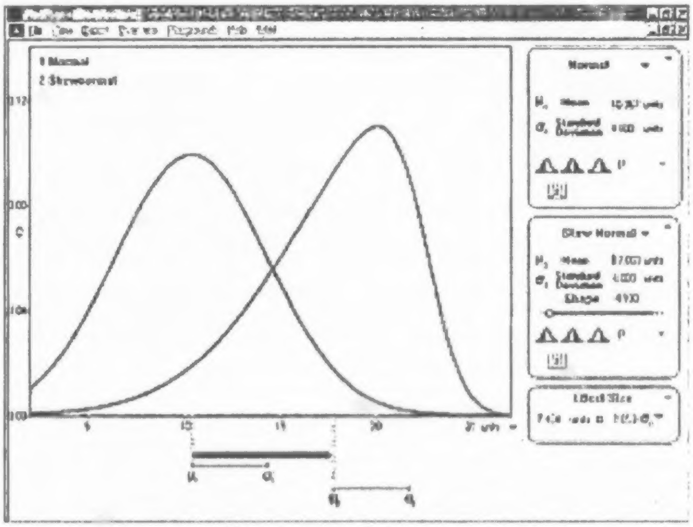

Figure 2: The clean, spare interface we constructed for StatPlay 1.0. Many elements allow interactivity: Click and drag to change the display immediately and smoothly, and to see immediate changes in linked aspects. For example if the left mean symbol is dragged, the left distribution moves, the effect size arrow (below, between the means) changes length, and the relevant numerical values at right are updated continuously.

Commercialisation

We realised from the start that commercialisation was needed if StatPlay was to be available to statistics learners worldwide. Strong interest by Australian editors of major international publishers led us to submit through them prototypes and proposals to head offices in the US and the UK. In 1998 I visited a number of these in the US. Their assessments of StatPlay, based on independent reviews, ranged from positive to extremely positive, and we were offered several contracts. The problem was that publishers wanted a product covering the full introductory course. Our plans required a minimum of 2-4 extra person years of development effort to produce such an expanded version, and no publisher was prepared to make the up-front investment to support this work. Had we been able on grant funding to take StatPlay to the brink of being a product covering a full first course we would certainly have had at least 3 major international publishers vying to take it up.

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We prepared business plans and summary proposals, and made innumerable presentations to venture capital sources, business angels, software publishers, and various government bodies. The response was invariably positive and encouraging, but did not lead to the investment StatPlay needed. This endless work diverted our efforts from development of StatPlay and, of course, our academic day jobs did not go away.

One promising commercial partner (to be referred to as CP) reviewed StatPlay in 1998. After independent assessments, presentations, and much work on a business plan, CP's Board approved in principle the investment of more than A$630,000. In conjunction with a major international publisher, CP undertook market research internationally. CP's Board reviewed the proposal and confirmed its intention to invest and to manage the project. We worked closely with CP to develop the business and development plan in great detail, to expand StatPlay and market it worldwide. Eventually, despite our great efforts, in late 1999 CP withdrew. Various management and business model problems contributed, and CP stated that IP difficulties were crucial. We were immensely disappointed and frustrated, and exhausted after years of effort towards commercialisation. All funding had run out, and our software developers had to leave.

CP's solicitor was faced with a formidable pile of paper defining StatPlay IP. The pending status of the Melbourne-Monash grant's IP was stated to be a problem, as was uncertainty of IP in relation to the five CAUT-CUTSD grants, despite a public statement (at last) in mid-1999 that DETYA did not claim IP ownership. Several aspects of the CAUT-CUTSD IP that were identified as questionable by CP's solicitor have never been fully resolved.

It is a tragic waste to have an effective product little used, especially when it represents some 15 person years of effort. We would still be pleased to hear from any potential commercialisation partner, although now a development team would need to be assembled. We hope to make StatPlay in its current state available on the internet, but at this stage even the small remaining hurdles, including IP, loom large, and additional support to achieve this availability would seem extremely cost-effective.

PD and Models for Products

StatPlay afforded a number of models for products: Should it be software integrated into a statistics calculation package, such as SPSS? Should it be stand-alone discipline-neutral software, intended to supplement a statistics textbook in the student's discipline (e.g., biology, psychology, business)? Should StatPlay be tailored to fit with leading statistics textbooks, in various disciplines, and sold in a bundle with such texts? Should the main income be from sale of one-use workbooks, or of the software on CD, or from downloads of the software? In discussion with publishers and other potential commercialisation partners we explored numerous possibilities.

Central issues included software licences and copy protection; whether students would be willing to pay for a software tool in addition to a textbook; to what extent we needed to include statistics calculation facilities in StatPlay; and whether learning materials accompanying StatPlay could be generic or would need to be tailored for each major discipline in which students take introductory statistics. These issues had immense implications for what we built, how much time and money was needed, and the chances of successful commercialisation. Such issues are crucial in the commercialisation component of PD.

Our choice of Visual C++ committed us to a large project requiring substantial funding, but was necessary for excellent graphical representations, smooth interaction, and the wonderful Sam demo facility. Our decision in 1997 to build our own clean interface undoubtedly made StatPlay 1.0 better than Classic. Had the commercialisation with CP proceeded there is every chance that a fine product would have reached the world market, thus vindicating our ambitious 1997 decision. With hindsight it would have been better to work further with Classic, publish it as a first-version tool, then if that was successful develop subsequent versions with increased coverage and perhaps an improved interface.

Our diverse funding sources gave complexity of IP, and dealing with IP took vast time and energy. We were told we were an early case, IP policy was being developed, and later projects would have an easier road. I hope so, although I am not convinced. IP uncertainty, or even complexity, can be fatal to the chances of commercialisation.

The main lesson of StatPlay is that a major educational multimedia project has many aspects, which interact in complex ways and may each influence the prospects for commercialisation. For example, our choice of Visual C++ (which I still regard as correct and essential for achieving the StatPlay we wanted) had implications for funding needed, and thus for IP complexity, both of which were key elements in the ultimate failure of commercialisation. The commercialisation component of PD is crucial and requires work throughout the life of a project. There are many models for commercialisation that need to be considered.

Models for Commercialisation

What models for bringing to the world software for statistics learning are most likely to be commercially successful? Experiments in the market continue: Here are some examples:

- *Textbook with ancillary software* Smithson (2000) is a fine textbook that emphasises CIs, sold with a CD containing limited ancillary software.
- *CD with text and software* AktivStats (Data Description Inc., Online) is a CD offering a hyper-textbook on the screen, with video clips, datasets, small simulations and a statistics calculation facility. It aims to be cross-discipline.
- *Shrink-wrapped software, with associated books* Fathom is powerful software with an excellent interface. Software licences are for sale and also textbooks written specifically to exploit the software are available (Key Curriculum Press, Online).
- *Workbook plus CD* Visual statistics 2.0 (Doane, Mathieson, & Tracy, 2001) is a workbook with CD that covers the first course and aims to supplement a discipline-specific statistics text. There are many exercises and data sets. The software offers calculation facilities and simulations, but does not approach StatPlay's interactivity.
- *Excel worksheets on the web* Rodney Carr (Online) offers over the internet XLStatistics, an inexpensive set of Excel worksheets that illustrate many statistical concepts and provide data analysis facilities.
- *Java applets* A variety of Java applets (e.g., Globally Accessible Statistical Procedures, Online) are available online, many of them free, but generally without links to a full curriculum.

These options, and more, are currently being tested in the market. Of course different educational domains may need variations on the models that have been chosen for statistics. It remains unclear which options might succeed, and under which conditions.

Educational developers may find commercial issues tedious or distasteful, but in most cases commercialisation is the only way that even wonderful materials will make an educational mark in the world, and can be assured of ongoing maintenance and development as software, hardware, and educational expectations change. Many product model options, and ways to commercialise, need to be considered from early in the life of a project: Doing so is the vital extra ingredient that PD has over Educational Design.

ESCI and Visual Understanding of CIs

Reform of statistical practice in psychology (Wilkinson et al., 1999) requires among other things increased use of CIs. Cumming and Finch (2001) presented a tutorial account of CI use, with particular attention to CIs for the standardised effect size Cohen's *d* (also known as *d*). These CIs are little-known to psychologists, but their use needs to become routine if reform is to succeed. Their calculation requires use of noncentral-*t* distributions and an iterative algorithm, not mere application of a formula.

I developed interactive graphical worksheets, running under Microsoft Excel, to illustrate the concepts and allow users to find CIs for their own data. These worksheets are the start of ESCI, which has the general aim of encouraging better understanding and wider use of CIs. ESCI will emphasise CIs represented visually, for example as error bars on graphs. Cumming and Finch (2001) is illustrated by screen images from ESCI and readers may obtain the software at small cost (ESCI, Online).

Microsoft Excel for Interactive Graphical Simulations

Try this simple experiment: In an Excel worksheet enter a few numbers and insert a simple chart of those numbers. Use View-Toolbars-Forms to show a toolbar, click the scroll bar icon and insert a scroll bar in the worksheet. Right click the new scroll bar, select Format Control and point the Cell link to one of the numbers. Then use the scroll bar to change the chart dynamically—yes, graphical interactivity is as simple as that! If you position cells that change (e.g., sum of the numbers) behind the chart, dragging the thumbnail in the scroll bar will change the chart smoothly and continuously.

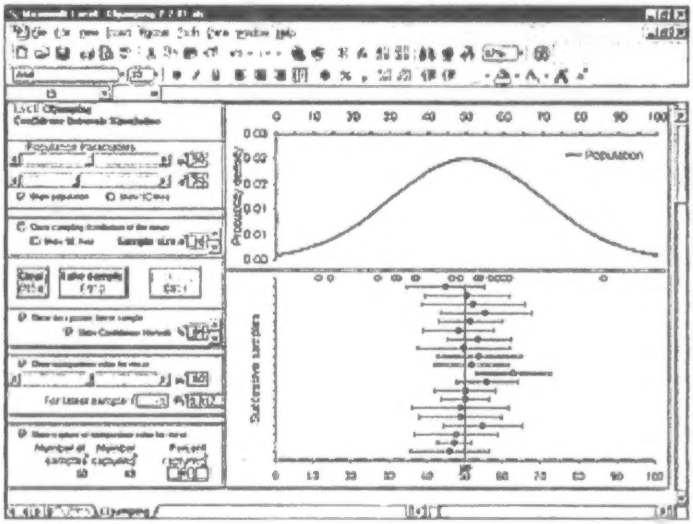

Figure 3. The ESCI worksheet ***CIjumping****, illustrating variability of the CIs based on successive independent samples from a population. The horizontal line of open circles is a dotplot of the latest sample. The open-circle mean has a CI that does not capture μ. Many aspects of the simulation and the display are under user control. Click the Run-Stop button to see a stream of independent samples cascade down the screen.*

That is the basis of ESCI. Figure 3 shows an image from **CIjumping**, an ESCI simulation with a fragment of the functionality of StatPlay. A different ESCI simulation allows exploration and calculation of CIs for Cohen's *d*, and uses Excel's Goal Seek to carry out the iteration. The user sees two noncentral-*t* distributions 'hunt' back and forth on the screen as they home in on the correct CI. I hope this helps the user understand something of the process as well as obtain the values of the CI.

Excel provides basic data handling, statistical calculation and graphing facilities, but if Excel development is pushed too far it becomes a Visual Basic programming exercise that may approach in complexity the Visual C++ task of developing StatPlay. Excel does, however, offer a practical way to achieve limited goals quickly, and without the need for major funding and an expert software development team.

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Project Design for ESCI

ESCI has both a narrower focus than StatPlay and a much more restricted range of possible representations and interactivity. There is no Sam and only a small set of interface components. But **CIjumping** took a few days to develop, whereas StatPlay's Sampling Playground took more than a year of expert software developer work-plus the effort needed to raise the funding, develop the specification, and manage the project.

The PD for ESCI is modest: Build simulations to illustrate concepts and techniques described in journal papers, and to provide calculation facilities. Distribute the software via the site of an e-commerce company and credit any income to a university account to support further development and research. IP issues are straightforward.

I intend to publish further papers on the use and interpretation of CIs, and these will be supported by further components of ESCI. I also plan to develop ESCI as the basis of a new introductory statistics course for psychology students based on visual representations, with few formulas and an emphasis on issues and techniques that reformers advocate. If successful this may lead to a published workbook or textbook.

ESCI's goals are limited, but the beauty of the ESCI PD is its modesty and scalability. The extent to which it is taken up will depend not only on its perceived usefulness, but on whether I can publish the planned papers, and the prominence of the journals in which they appear. Additional publicity via email discussion groups, conference papers and workshops may assist. ESCI would contribute directly to the reform of statistical practices if it is taken up and used by researchers and teachers. It may also contribute indirectly if it prompts other authors and software developers to adopt its techniques and representations.

Conclusions

Software Tools for Development

The choice of software development environment is as crucial now as it was for StatPlay in 1993. One major choice is between a full programming language (Visual C++ or Java) plus an overlaying set of developer's tools, or Excel plus some use of macros and Visual Basic. The latter represents an 80-20 solution: Specialised programming expertise is not required, much functionality is given by Excel itself, and development is very fast, but there are many limitations on what can be built.

These two major options may converge, with improved overlaying tools for Java allowing faster development, but I suspect such advances may be limited and specialist programming expertise will still be required. I would prefer to see major advances in the power of Excel, without the need for full use of Visual Basic. That could bring even greater scope to Excel users, without higher-level programming skills being required.

The Development Team

Major educational software development requires a team with expertise in the subject domain, educational design, graphics and interface design, software development, and project management. However if specialised programming expertise is not required it is more likely that one or two academics can come close to providing this range of abilities. Having a small team—with at most one expert programmer—avoids the problem that a large team requires specification and development processes that are more formal and bureaucratic, and inevitably raises more complex issues of IP, funding, personnel, and management. Whether the team is large or small, however, it may also need to draw on a range of commercialisation skills, as required to implement the PD.

Policy to Encourage Commercialisation

If a university or funding body wishes to facilitate dissemination and ensure ongoing maintenance it needs to support commercialisation. Beside funding for educational and software development it would be highly valuable if it provided management support to take primary responsibility for most aspects of commercialisation. This is probably the single biggest lesson from StatPlay: If others with appropriate commercial skills had been available to undertake much of the work towards commercialisation, success would have been more likely. In addition we would have been able to achieve better and faster development of StatPlay itself.

Providing specialist support for commercialisation should surely be cost-effective, and would allow academics to use their expertise to develop wonderful educational materials, rather than be diverted for countless hours into bureaucratic and commercial activities. Had we foreseen the enormous drain these latter activities were to have on us we would not have commenced StatPlay, or would have restricted ourselves to a much more modest project. It would of course be appropriate for any provision of major help towards commercialisation to be reflected in the allocation of percentages of ownership and/or returns.

Project Design to the Fore

It is interesting to speculate on the PDs of StatPlay and ESCI. A full StatPlay may have had market success, not least because of the expense of developing a competitor. But a large investment may become vulnerable to products developed cheaply with improved tools. Competitors to ESCI could be easily developed, so ESCI may need to inhabit educational (and market) niches and move quickly. However the current position is that StatPlay did not reach the market, and ESCI is recent and, although the first parts are available to the world, it is largely unproven.

I am arguing that Educational Design must be extended to PD. Overcoming the obstacles to educational dissemination requires careful attention to all aspects of PD. Project proposals should specify a full PD-perhaps not at first, but early, after an initial proof-of-concept stage. Commercialisation is in most cases essential if software is to be taken up widely, and to be updated to remain contemporary in the fast-moving world that students inhabit. There are many models for commercialisation to be considered.

It is hardly original to say that commercial issues matter, but I am arguing that they need much more attention than they often receive, and they need this throughout the life of a project. Commercial issues are likely to influence, and be influenced by, many aspects of a project; they need to be integrated into a comprehensive PD. Developing then following a full and powerful PD may be essential steps in achieving worthwhile educational change.

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3D LEARNING ENVIRONMENTS IN TERTIARY EDUCATION

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Abstract

Recent advances in desktop computer graphics hardware and associated software have made 3D environments feasible for mainstream educational use. This paper examines the potential applications of 3D environments in tertiary education. Characteristics of a 3D Virtual Chemistry Laboratory currently under development are described in order to illustrate the ideas discussed. The paper concludes by identifying key research questions that need to be addressed.

Keywords

3D, virtual environment, virtual reality, simulation, microworld, visualisation

Introduction

In recent years, teachers in a variety of educational settings have begun to make greater use of information and communication technologies in their teaching. Such technologies have the potential to make learning resources more accessible, to allow a greater degree of individualisation and to make the learning process a more active one. Recent developments in desktop computer hardware and software have made feasible a new application of learning technologies, the 3D learning environment. It is argued in this paper that such environments can situate learning to a greater degree than traditional multimedia learning resources and can facilitate individual knowledge construction through new types of learner-computer interaction.

Background

Virtual Reality and Virtual Learning Environment have become increasingly ambiguous terms in recent years. For example, Moore (1995, p.91) states that "Virtual reality falls into three major categories: text-based, desktop and sensory-immersive VR". Text-based VR, of which MUDs and MOOs are examples, is outside the scope of this paper. The term Virtual Learning Environment has begun to be used to encompass any Internet or Web based learning resource with associated discussion tools. The term 3D environment has been chosen to focus on a particular type of virtual environment that makes use of a 3D model.

Specifically, the main characteristics of a 3D environment are as follows:

- The environment is modelled using 3D vector geometry, meaning that objects are represented using x, y and z coordinates describing their shape and position in 3D space.
- The user's view of the environment is rendered dynamically according to their current position in 3D space.
- The user has the ability to move freely through the environment and their view is updated as they move.
- At least some of the objects within the environment respond to user action, for example doors might open when approached and information may be displayed when an object is clicked on.

Additionally, some environments include 3D audio, that is, audio which appears to be emitted from a source at a particular location within the environment. The volume of sound played from each speaker depends on the position and orientation of the user within the environment.

Much of the early 3D environment research focussed on physically immersive environments, which require expensive hardware such as head-mounted displays, rather than desktop environments, which use standard computer hardware. The focus of this paper is primarily on desktop 3D environments. Recent advances in the capabilities of standard desktop computers allow highly complex 3D models along with 3D audio to be delivered at realistic frame rates and with very fast response times (Kelty, Beckett & Zalcman, 1999). Robertson, Card and MacKinlay (1993) argue that desktop 3D environments can be easier to use than immersive environments because people are already familiar with the desktop computer, and do not subject the user to the physical and psychological stress often associated with immersive environments. Additionally, the development and proliferation of the Internet, has made possible the development of distributed 3D environments which can be explored by multiple learners together, from separate locations. Although physically immersive environments may be more suitable for some educational applications, for example applications that focus on sensory motor skills, it is argued in this paper that desktop 3D environments have potential across a range of discipline areas.

3D Environments and Learning

3D environments have the potential to situate the learner within a meaningful context to a much greater extent than traditional interactive multimedia environments. The sophistication in the rendering of objects, the independent behaviour of objects within the world, and the degree of interaction available, allow for situated tasks that are both meaningful and intrinsically motivating for learners. This section looks at existing educational applications of 3D environments and applications that have been suggested in the literature.

A frequently discussed application of 3D environments is the exploration of places that cannot be visited, such as historical places, outer space or the ocean floor. For example Alberti, Marini and Trapani (1998) describe an environment modelled on an historical theatre in Italy. A related application is the exploration of models of microscopic objects, such as molecular structures (Tsernoglou, Petsko, McQueen & Hermans, 1977, cited in Wann & Mo-Williams, 1996).

By allowing the learner to manipulate objects within the environment in addition to being able to move around, there is potential for the learner to develop a much greater level of understanding of the situation modelled. For example, in the discipline of physics, students are expected to understand how objects will respond to forces. By exploring an environment that allows for specific forces to be applied to objects and for the resultant object behaviours to be observed and measured, a learner is likely to improve their conceptual understanding.

Another application of 3D environments is in situations where the learner needs to master some skill. It is particularly appropriate to use 3D environments in situations where the tasks being learned are very expensive or very dangerous to undertake. For example, 3D environments have been used to train nuclear power plant workers in Japan (Akiyoshi, Miwa & Nishida, 1996 cited in Winn & Jackson, 1999). Another example is the use of such environments to train astronauts in how to repair a space telescope (Psotka, 1994 cited in Moore, 1995). However, 3D environments may be of value for any tasks that cannot be conveniently carried out by learners as often as they need to or at a convenient time.

Winn and Jackson (1999, p.7) suggest that 3D environments "are most useful when they embody concepts and principles that are not normally accessible to the senses". For example, they discuss the modelling of concepts such as justice. They use the term "reification" to describe the representation of phenomena that have no natural form. An example is the 3D environment for developing learner's understandings of geometry described by Kaufmann, Schmalstieg and Wagner (2000).

Hedberg and Alexander (1994) emphasise the ability of virtual environments to situate learning within a meaningful context. Because a 3D environment can provide a level of visual realism and interactivity consistent with the real-world, it is possible that ideas learned within the environment will be more readily recalled and applied within the corresponding real-world environment. This is a logical corollary to the theory that knowledge can be internally anchored to experience. This theory is supported by research carried out by Baddeley (1993) suggesting that information learned by divers under the sea is better applied while diving than information learnt on land. It is also supported by Brown, Collins and Duguid's theory of Situated Cognition (1989) and by the Cognition and Technology Group at Vanderbilt's theory of Anchored Instruction (1992).

Virtual Chemistry Laboratory

The Virtual Chemistry Laboratory is an accurate model of a chemistry laboratory used in teaching at Charles Sturt University. The initial version has been designed to allow a learner to become familiar with the layout of the actual lab, as well as to find out information about procedures to follow in using the lab. It has been developed using the Virtual Reality Modelling Language (VRML) and is accessed through a web interface. Learners can explore and manipulate items of apparatus within the lab, and by selecting an item can view information about the use of that item. The contents of the introductory chemistry laboratory manual is also accessible from within the lab. The current version can be explored online (Virtual Chemistry Laboratory, Online).

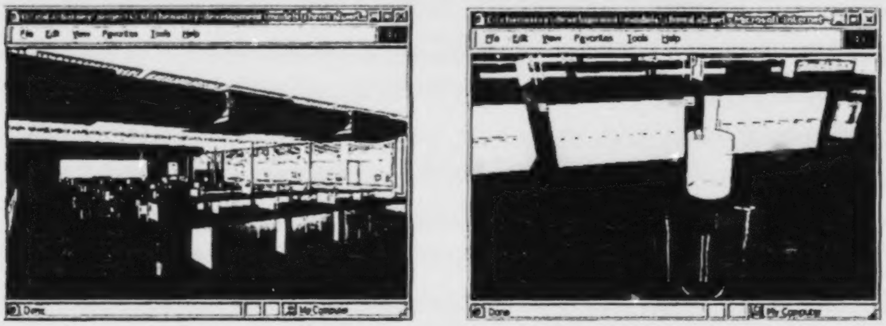
File Edit View Favorites Tools Help
Done
My Computer
File Edit View Favorites Tools Help
Done
My Computer

Figure 1: The virtual chemistry laboratory

The next phase of development will focus on facilitating the learning of fundamental concepts in chemistry through the undertaking of virtual experiments. A feature of the simulated experiments will be an option allowing the learner to zoom in to the molecular level. As well as visually simulating the experiments, the enhanced virtual laboratory will include logging of student activity and context-sensitive pedagogical guidance. It is intended at a later stage to enhance the environment so that each learner present within the laboratory is represented by an avatar and to include a facility to allow learners to communicate with each other. This would allow, for example, learners to undertake virtual experiments together as a group, under the supervision of laboratory demonstrators.

Conclusion

This paper has discussed the potential educational applications of 3D environments. Although the potential of 3D environments as learning resources is clear, there is still a great deal of work to be carried out before designers can be sure about where 3D environments should appropriately be used and about how best to design them. There is now a growing body of literature describing examples of educational 3D environments. However, there is a notable lack of published data from formal evaluations of their effectiveness. There is also a need for research that investigates the degree to which 3D environments do in fact assist in 3D cognitive encoding, and the degree to which such encoding aids in understanding, recall and application of knowledge. Additionally, if such environments are to become widespread, they need to be easy to use, and consequently work needs to be undertaken to derive useability guidelines for designers.

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SUPPORTING LEARNING IN ENVIRONMENTAL ENGINEERING: INTERACTIVE WATER TREATMENT PROCESSES

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Abstract

Teaching and learning environments which use multimedia based resources have the potential to greatly improve the effectiveness and efficiency of learning by engaging students at a deeper level than may otherwise be possible. The presentation media and teaching methods work together to enrich the experience, providing the students with a greater opportunity to explore their own 'mental pictures', develop understanding and revise it as necessary. This is particularly so in situations where 'real world' phenomena and processes are being taught. Using such a multimedia package in teaching pollution control processes is novel. This paper reports on the successful development of a multimedia package dealing with several pollution control processes and its evaluation. Teaching the design concepts for these processes in a conventional classroom setting is challenging because students have difficulty in visualising the techniques and processes involved. This difficulty is compounded by the fact that many of the processes occur naturally over longer time periods and so cannot be easily be integrated into normal teaching environments. The software package incorporates several different media modes including text, animation, and simulation. A pilot evaluation of this package using third year engineering students indicated that it supported the development of greater insight and understanding of the complex treatment processes being taught.

Keywords

water treatment, simulation, environmental engineering, multimedia, student centred learning

Introduction

The utilisation of interactive, multimedia based tools and delivery mechanisms in teaching and learning environments is becoming an important aspect of the implementation of a more innovative approach to teaching in all disciplines including engineering. The value of the delivery mechanism in the learning process has long been under debated. While many side with Kozma (1994), accepting that the delivery vehicle is as important as the teaching methods, there are many who are convinced by Clark's (1994) argument that media will never influence learning. The authors of this paper however take the view along with Reiser (1994) and others, that the two must work together and that in fact, it is the delivery vehicle which in many cases facilitates the use of particular methods.

One of the key elements of a multimedia learning environment is its ability to provide the learner with control, which is the essential feature of a "democratic environment" for learning. Current interactive multimedia technologies can represent ideas in almost any mediated form, and provided we can generate a comprehensible metaphor for organising our functional options and the underlying knowledge structures, the student can roam through the resources, creating their own meanings and understandings of the phenomena they encounter. (Corderoy, Wright, Harper & Hedberg, 1996).

It is suggested by Jonassen (1988) that learning environments that utilise interactive multimedia have a number of attributes that are essential to efficiency and effectiveness. In particular, interactive multimedia provides opportunities for higher levels of engagement, improves representation of information so that there is a 'closer fit' with the formats the current generation of learners are familiar and comfortable with, and facilitates contextualised feedback. Such highly interactive environments allow the learner to learn at his/her own pace at a time and place that is most convenient and 'supportive', and to be 'selective' in the overall experience he/she has while navigating the learning environment. Recent research into learning processes (Jonassen & Reeves, 1995) focuses on the students and the 'cognitive tools' such as simulations, they have at their disposal as 'intellectual partners' in the learning process.

It is the purpose of this paper to outline an interactive multimedia teaching resource based on the constructivist paradigm (Reeves, 1993; Jonassen, 1991; Winn, 1993) and present some early results from the evaluations carried out.

Simulating "Real World" Processes

The processes described in this multimedia software package demand some imagination to understand the principles and the continuous and often extended nature of their operation. Also, there are several components of the processes that are difficult to explain or demonstrate without the aid of 'real world' experience or a substituted laboratory simulation. The functions and processes of these components can be easily demonstrated using pictures, hyper linked text, simulation and modelling techniques to provide risk free environments in which the user may 'experiment at leisure' to come to terms with the difficult concepts involved and thus gain a deeper understanding of the systems at work.

In general, simulations

> ...greatly enrich the 'quality' of the problem solving process for the user by providing unhindered access to act and become immersed in a 'real' situated process, manipulating the various causal parameters and testing hypotheses without a 'real' consequence or risk and in a time frame which is convenient and manageable for them and enabling the learner to ground their cognitive understanding in their action in a situation. (Laurillard, 1996).

At the same time, well structured simulations which are based in open ended models provide users with much richer learning experiences by "allowing the monitoring of all parameters while the simulation is running, with the aim of exploring the relationships between them." (Corderoy, Harper & Hedberg, 1993).

Multimedia in Engineering

A multimedia approach can be a very useful tool for teaching fundamental concepts in Engineering. For example, in the case of sedimentation process, the process depends on the settlement of particles under gravity. Under discrete settling conditions, the settling of particles is given by Stokes' equation (Metcalf & Eddy Inc., 1991):

$$v_s = \frac{g(\rho_p-\rho)d_p^2}{18\mu} \quad (1)$$

where, v_s = vertical settling velocity of the particles
g = gravitational acceleration due to gravity
d_p = particle size
ρ_p = density of particles
ρ = density of water
μ = dynamic viscosity of water

Equation (1) gives the vertical velocity of the particle. However, in a continuously operating sedimentation tank, the particles are also transported in the horizontal direction as well. The horizontal velocity of the particle can be given by:

$$v_h = \frac{Q}{wh} \quad (2)$$

where, Q = inflow rate in to the tank
w = width of the tank perpendicular to flow
h = depth of the tank

The particle removal depends on the magnitude of vertical and horizontal velocities and without some way of 'visualising' this process (such as a simulation in which the user has control of the variables), students may not develop a full understanding of the process. This package offers students the opportunity to test their mental models of a number of complex processes involved in water treatment. Further information about the package and its design can be found in Dharmappa, Corderoy and Hagare, (2000).

Evaluation

A pilot study was conducted to evaluate the package using 30 students from the third-year BE (Civil & Environmental Engineering) course at University of Wollongong, Australia. A questionnaire consisting of 2 parts was prepared and it was administered to all the students. Part A this questionnaire dealt with the design and functionality issues of the software while Part B explored the students impressions of the impact using the software had on their overall learning.

General Findings

Although the sample was small, this simple formative survey provides valuable starting points in terms of design and educational considerations in the development of such teaching resources. The students indicated that the animations and simulations included in the package were very useful to them in testing their 'mental models' and developing understanding. The students particularly liked the level of interactivity included in the simulations of processes that they would not otherwise have the opportunity to observe. In terms of general design issues, most felt that navigation through the package was relatively easy and the instructions for using it were clear and accurate. In terms of the student's perception of its impact on their learning experience, comments made by a number of students indicated that its main impact was that simulations let them 'explore' the processes, providing them with a "better understanding of what makes the process work". There was also a perception that they were better able to contribute to tutorials having used the package.

Conclusion

The software package that is the focus of this paper is designed to give students some idea of the actual operation and design of various water pollution control processes. It also explains and consolidates their understanding of the operating principles and performance of the processes, by providing them with the opportunity to engage and interact within a rich, student-centred learning environment whilst constructing their knowledge. A limited pilot study using third-year undergraduate engineering students indicated that the multimedia software is a useful tool to support learning for students in Civil & Environmental Engineering and has provided impetus to further develop this resource. An extensive program of evaluation using a larger cohort is scheduled for the later stages of 2001.

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ELECTRONICALLY ENHANCED CLASSROOM INTERACTION

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Abstract

A design rationale for introducing electronic equipment for student interaction in lecture theatres is presented, linking the instructional design to theory. The effectiveness of the equipment for learning depends mostly on what pedagogic method is employed: various alternative types are introduced. Prospective studies are outlined for exploring its use over new ranges of application. Rival views of the concept of interactivity are one way to organise the evaluation of this learning technology.

Keywords

creative solutions, overcoming limitations, innovation, convergence, design rationale, niche, feedback, group response

Introduction: The Design

This paper describes the design rationale for introducing electronic equipment for student interaction in lecture theatres, and the studies now in prospect of the use of this equipment.

The equipment is essentially that of the TV show "Who wants to be a millionaire?": every member of the audience (i.e. each learner in a lecture theatre) has a handset similar to that of a TV remote control, the presenter displays a multiple choice question (MCQ), each learner transmits the digit corresponding to their chosen answer by infrared, a small PC (e.g. a laptop) accumulates the answers, and it displays, via the room's projection system, a bar chart representing the distribution (totals) of the responses to audience and presenter alike.

This may be called (following Michael McCabe) a "Group Response" (GR) system. Its essential feature is that, regardless of group size, both audience and presenter get to know the distribution of responses (alternatives chosen), and how their own personal response relates to that distribution, but however without knowing who chose what. This means everyone contributes, and the representativeness of each response is also exactly known. On the other hand, the privacy of the choice means that, unlike in face to face groups, each individual can express the choice they incline to, rather than only a choice they feel able to explain and justify to others. These are quite often different both in science learning and in social processes.

The main pedagogic categories of use of the equipment are:

- **Assessment**, both formative and as practice for summative assessment. Here the MCQs are meant to test content knowledge, and perhaps are drawn from a bank used for formal assessment on the course. The advantages of the equipment here are that "marking" is fully automatic, each learner can know immediately if they gave the right or wrong answer, how their performance on the question compares to the group as a whole, tailored explanations may be given by the presenter, and the presenter equally sees immediately how well the class measures up on that question (feedback from learners to teacher). The feedback cycle here takes about two minutes per item (somewhat longer if explanations are given). Any kind of MCQ may be used, provided the response is a single selection from a small fixed set: whether the usual rather shallow item, or one designed to probe understanding more than information retention (possibly by prior use of phenomenography (Marton, 1981; Marton & Booth, 1997) to map the common misconceptions).

- **Formative feedback on learning** within a class (i.e. within a contact period). Similar items might be used, but in order to discover and demonstrate what points should be focussed on during the class. Thus one or several such question items at the start of a class could be used to select a topic for detailed coverage, while the same or similar items at the end could demonstrate to what degree the group now understood the topic.

- **Formative feedback to the teacher** on the teaching (i.e. "course feedback"). While the standard questionnaire at the end of a term, semester, or course has in general only a small effect on changing anything (Cohen, 1980) and takes a year to do so, a quick on the spot anonymous poll half way through a class (e.g. on whether the pace is too fast or too slow, the jokes too numerous or infrequent, the examples too many or few) can be used to change things immediately. Making adjustments to the teaching every 30 minutes, instead of only once a year, and furthermore making them for the particular group that gave the feedback, is much more likely to be effective than the usual practice.

  Even better on the spot evaluation might be done by asking students what the best and worst issues are in the teaching at present. Assuming that even a handful are willing to mention an issue to the teacher's face, these can then be put as questions to the class, and an accurate secret ballot taken on the breadth of support for each one. This cycle of an open-ended evaluation probe, followed by systematic (and quantitative) measures of the issues thus identified, is the best evaluation practice: much better than using standard course questionnaires for all classes, learners, teachers, and contexts. Normally it would take days or weeks: but the whole 2-phase cycle could be done within 10 minutes.

- **Peer assessment** could be done on the spot, saving the teacher administrative time and giving the learner much more rapid, though public, feedback. For example if each student has to give a verbal presentation and this is peer assessed, then at the end of their talk the teacher can display (say) each of 10 criteria in turn, and get the other students to enter their mark for this anonymously but on the spot, with the totals displayed.

- **Community mutual awareness building**. At the start of any group e.g. a research symposium or the first meeting of a new class, the equipment gives a convenient way to create some mutual awareness of the group as a whole by displaying personal questions and having the distribution of responses displayed. For example, at a research meeting start by asking people's ages (which illustrates the advantage of anonymity), and the kind of department or institution they come from, and some alternative reasons for attending. At the start of a class, I might ask whether each student is straight from school or not, their gender, which faculty they belong to, whether they signed up for the course because it is their main interest, a side interest, or are just making up the number of courses they do.

- **Experiments using human responses**: for topics that concern human responses, a very considerable range of experiments can be directly demonstrated using the audience as participants. For instance visual illusions may be displayed and the equipment used to show what degree of uniformity of response is found. Priming effects can be shown, where the perception of an ambiguous word or display is affected by what was shown before. The performance of witnesses to a crime (including the effects of some well known biasses) can be explored by showing a short film, followed by various questions about what was shown. Social psychology effects, e.g. on conformity, could be demonstrated if responses to early questions were faked to see whether the class then changed their responses to later questions. In general, experiments that rely only on a stimulus and a forced choice response, but not on accurate measurements of reaction times, can usually be demonstrated in this way. Thus for the particular case of psychology, but also for parts of physiology, medicine, economics, and so on, direct demonstrations of relevant effects can be mounted.

- Possibly the most productive application, however, and the one with the largest body of existing research, is in using the equipment to **initiate a discussion**. Here, a carefully chosen MCQ is displayed and the learners register an answer, thus privately committing to a definite opinion. The presenter then, however, does not indicate the "right" answer but directs the class to discuss their answers with each other. Having to produce explanations and reasons is powerfully "mathemagenic" (conducive to learning), which of course is why researchers learn so much from giving talks and writing papers, and why teachers make their students write essays and answer questions. The equipment can be a significant help in introducing this, even into large classes. This method of teaching by questions has been widely used and researched, although mostly without electronic aids (Hake, 1998a, 1998b).

Justification or Design Rationale

Although techno-enthusiasts, and indeed many government agencies or departments, have been pushing the use of computers and other technologies in education, and there are now many people whose job is essentially this and who are therefore necessarily aligned with this indiscriminately positive attitude, there is still very little good evidence of benefits. Perhaps this is not surprising: Landauer (1995) found it very hard to discover evidence of economic benefits for using computer technology in general. Besides suggesting that developing evaluation methods powerful enough to test this may be a more important, if more difficult, research task than generating yet another application of technology to learning, this does mean that each application should be carefully justified. In a review of a number of applications (Draper, 1998), I argued that most applications showed no significant improvements over what they replaced, but that the few striking positive exceptions were characterised by "niche-based design": by a good fit between a particular learning situation and a specific technical solution. They were projects that had been inspired by identifying a specific weakness in current delivery, and had focussed technology on solving that problem rather than on replacing what had been adequately done before. Can the use of the classroom equipment described above meet the implied standard of justification?

In considering large classes in large lecture theatres, the main problem is usually analysed as to do with the lack of interaction and the consequent extreme passivity imposed on the audience. In terms of Laurillard's model of the learning and teaching process (Laurillard, 1993, p.103), this situation fails to support the iterative interaction between learner and teacher that is one of her underlying principles, and more specifically does not support even activity 2: the "re-expression" by the learner of what the teacher has expressed. (This can be seen as corresponding to the constructivist requirement that learners acquire knowledge by rebuilding it on their own personal, mental foundations. Redescribing it in their own terms is an activity that powerfully promotes this.) Actually, with highly skilled learners and a teacher reasonably in tune with the group, this can nevertheless take place: for instance, where the learners take notes that are not mere dictation, but substantial re-formulations of what is being talked about. (This is a reasonable theoretical analysis of the considerable benefits I have often obtained from listening to talks at conferences where I have not asked questions, but have nevertheless learned something useful.) However this degree of skilled, silent interaction is not often present in undergraduate teaching, and large numbers usually prevent learners asking sufficient questions to repair the attunement between speaker and audience, from both a pragmatic (there isn't time for many people to ask questions) and a social (it just feels too embarrassing) viewpoint.

That, then, is the diagnosis offered here of the chief weakness of lecturing to large groups. The handsets and associated equipment offer a way of tackling that weakness by (a) allowing each learner independently to generate an answer (at least a partial instantiation of activity 2), whereas otherwise only the handful who put their hands up really do this; and (b) to register that answer and so maintain the motivation for doing it; and in so doing (c) to affect the course of what happens next. This contingency (dependence of the teacher's behaviour on what the learners do) is true interactivity: one of the underlying principles of Laurillard's model, represented there by the to and fro repetition of activities between learner and teacher. The summed responses are real feedback to the teacher, that naturally leads to adjustments and reattunement if required, and in fact do this better than questions and answers from any subset of individuals. Furthermore the equipment offers an anonymity of response that addresses the shyness that additionally inhibits any interaction.

As mentioned in passing, there are some other reasons for expecting benefits with the types of pedagogic use other than initiating discussions. Formative, summative, and peer assessment could be made more convenient and quicker (and so more affordable for both learners and teachers in terms of time). Starting to build a sense of a learning community could get off to a quicker start, especially in large groups. Demonstrating experimental effects instantly connects the abstract overview given to a personal perception and experience of it: something very helpful to learning both for retention, comprehension, and for a fuller content of learning. The biggest learning gains, however, are likely to come from the much better and quicker feedback from learners to teachers, allowing better attunement of the delivery; and from the method of teaching by questions i.e. of discussions in class (whether in small groups, plenaries, or a combination) initiated by well designed questions and by getting each individual to start by committing to an initial position.

Is the equipment really likely to be any better than the alternatives? The simplest alternative is getting students to give a show of hands. This equipment crucially offers more privacy (it's a secret ballot, and important for just the same reasons). Other rival technologies are to issue each student with a cardboard or plastic cube with a different colour on each face, to be turned to show their "vote"; or with a large sheet of paper divided into a few squares each with a digit in, that the student can hold up in front of their bodies and point to the digit they select. These methods allow only near neighbours to see a student's selection. Thus the electronic equipment offers somewhat better privacy, but the difference may only be crucial with new classes: it is quite possible that with a class grown comfortable with the electronic version, moving over to a cheaper but less private version might not destroy the interactivity. The electronic version also provides faster and more accurate counting of the results: most presenters will only estimate shows of hands to about the nearest 20%, unless they have the patience to pursue and count exactly even with large groups. The accuracy may have a small but not negligible value in making all participants feel their views count, and are not just lost in crudely approximate estimates.

In scrutinising this instructional design rationale, note that it does not feature computers in a starring role (although actually one is crucial to tabulate the results): the instructional design mostly isn't in the equipment or software, but in how each teacher uses it. That is a lesson which perhaps the rest of the learning technology field should take more to heart if the aim is in fact to improve learning rather than to promote the glamour of machines. On the other hand, note too that this design does not fit with a simplistic interpretation of the slogan "learner-centred". Improved learning and the learners are the ultimate intended beneficiaries, but one of the important ways that end is achieved is by first serving the teachers better, by giving them much better, faster, and more detailed information on what the learners are thinking now, and where their problems are at each point.

Prospective Explorations

There is a considerable history and community of practice in using such equipment in the specific area of promoting discussion (the last of the pedagogic uses listed above) and so improving student understanding in science and engineering at the school and early university levels (e.g. Hake 1998a, 1998b). The authors have obtained sufficient equipment for several lecture theatres, and are about to begin exploratory studies, particularly with a view to exploring the range of applications, and how far its utility can be demonstrated beyond its best established application area. We hope to trial its use in all of the pedagogic modes listed in the first section, in two universities (Glasgow and Strathclyde), in at least two disciplines (psychology and computer science) in both universities together with several others as opportunities arise, at various levels (years) in undergraduate programmes, and in a range of group sizes from 300 students downwards. (The biggest need and the biggest potential gains are in the largest group sizes, but innovation is of course a lot "safer", i.e. easier to manage, in smaller groups.)

The exploratory studies should yield practical knowledge such as question banks for the participating disciplines, and how much support is needed for first time use (a new lecturer and students who haven't used the equipment) and for regular use. They will also yield evaluation results on what benefits can be demonstrated. We hope to use a version of the method of Integrative Evaluation (Draper et al., 1996) to address both these aspects.

Interactivity

According to Jim Boyle (personal communication), students are generally, although not universally, enthusiastic about this approach, even over long periods (e.g. regular use throughout a year). When asked if they regard the interactive equipment as an advantage or not, classes typically show a spread of opinion such as 70% for it, 20% indifferent, 10% definitely opposed to it. Investigating more deeply than general student preferences will require more, and more sophisticated, measures.

Some of the most important evaluation issues can be organised around the notion of interactivity. Some researchers tend to an almost mechanical interpretation of interactivity e.g. counting the number and branching ratio of choice paths for users in multimedia learning software (Sims, 1997; Hoyet, 2000). With this equipment, that corresponds to the number of questions put to the learners for them to respond to, regardless of their content. It also corresponds to the effects we may well see of novelty, of the perception that the teachers are taking special trouble over the teaching (the Hawthorne effect; Mayo, 1933), or simply of physiological arousal (the physical activity involved in pressing buttons i.e. mechanical interactivity) which has led to the heuristic rule of not lecturing for more than 20 minutes without a pause, having the audience move around periodically, etc. On the other hand, if we believe in the Laurillard model, then the important factor would probably be the amount of time each learner spends on activity 2 ("re-expression"): so using the handsets should be better than a non-interactive monologue, but not as good as time spent in peer discussion (open-ended verbal responses rather than selecting one of the digits on the handsets). In other words, the measure of it would be the number of mental and verbal responses a learner makes (in discussion) rather than the number of button presses on the handset. On the other hand again, if what is important about "interactivity" is actually changing what happens by visibly affecting the teacher (i.e. genuine human-human interaction with the actions of one party being contingent on those of the other), then it will be changes to what the session is used for as a result of responses to questions near the start that predict the largest learning gains. Varying approaches in classes, and taking independent measures both of learning and of enjoyment or alertness should eventually allow such questions to be decided. Measures taken over time (e.g. weeks) should allow any halo and Hawthorne effects to be independently identified, if they are present, with enthusiasm decaying as the novelty wears off, or performance being independent of the learning activity tried and only dependent on the perceived interest of the researchers.

Other Technical Details

There are some further detailed issues that arise, and could be investigated. The particular equipment used transmits not only a digit to signal the learner's selected response to the question, but also a confidence level (high, medium, or low), and an ID for that handset which may or may not have been arranged with a known mapping to the student's identity. Furthermore the number of attempts each learner makes at the question before the cut off time may be recorded. The GRUMPS (2001) project is interested in exploring data mining of records of such student interactions, though that involves negotiating issues of privacy and data protection with the students. We are writing software to smooth the integration of the equipment with other lecture facilities (e.g. the use of PowerPoint presentations), and with keeping records of the interactions.

There seem to have been a variety of particular equipment used in the past, and more than one type is currently available. For instance a one-button system has been used (Poulis et al., 1998), though that required each response option for a question to be attended to separately. Various numbers of buttons are offered in other equipment, and sometimes the ability to enter multi-digit responses and transmit them as one number. Wired, radio, and infrared implementations have been used. Currently infrared proves cheapest. Already technically feasible, though not yet financially attractive, is the solution of equipping every student with a radio-linked PDA (e.g. palmtop computer). Functionally, the features that can matter to further pedagogical tactics include: entering multidigit numbers (e.g. to identify the student), entering a sequence of digits to specify a sequence or set of response options rather than exactly one as an answer, and free text entry. When the latter becomes widely available, we can at last address a fundamental problem of discussion groups (such as research seminars) where many people want to ask a question: which is the best question to take for the group as a whole? Using only voice, we cannot know what the set of candidate questions is without having them asked. With textual group responses, everyone's questions could appear in front of the speaker and/or facilitator, and could then be grouped, sequenced, and sorted by priority. Meanwhile, as the technology (especially radio communication techniques) advance rapidly, we can focus on how we would use additional functions, and what their pedagogic rationale is.

Conclusion

The studies in prospect with this equipment should eventually allow us to pronounce on the validity of the design rationales presented in this paper. These studies will use measures of learning outcome, attitudes, and engagement as dependent (i.e. output) variables. They may range over, as independent (i.e. input) variables, two or more universities, three or more levels of university class and so student experience, two or more academic subjects, class sizes up to 300, and all the pedagogic strategy types described above.

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COMPARATIVE NUTRITION
FROM PRINCIPLES TO PRACTICAL FEEDING SYSTEMS

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Abstract

A problem-based online interactive teaching tool for nutrition has been developed structured around a General Animal Model. Supported by tutorials, the student applies concepts and mathematical processes for estimating animal nutrient requirements, assessing the nutritional value of food ingredients and formulating rations. Application to nutrition of each animal species is on a comparative basis, showing changes in equations and the underlying reasons.

Keywords

learning tool, nutrition, problem-based, online, mechanistic

Introduction

Based on 38 years experience in teaching nutrition and evaluating graduate proficiency, three key issues in the learning process have been targeted.

(i) Nutrition involves a widening variety of dietary ingredients. They include novel feed materials and materials modified by modern processing methods, affecting efficiency of digestion, absorption and utilization of nutrients in a complex manner affecting the balance of nutrients absorbed. Though students are well able to access descriptive information about the chemical nature of specific nutrients in food and about the metabolic pathways they enter in the animal, they are less well prepared to deal with interactions in quantitative terms or with the way in which the rapid analytical methods used in nutrition laboratories lump together different chemical entities for ease of calculations or for information transfer.

(ii) In going from qualitative description of digestion processes, absorption, metabolic pathways, and partitioning of substrate use between tissues, the mathematical representation of the processes in quantitative terms is often not sufficiently transparent. The equations and ways in which the calculations are made is often perceived to be empirical rather than an approximate mechanistic model representing nutritional processes in an effective and reliable way.

(iii) In quantifying the nutrient requirements of any animal or the ability of a diet to supply those nutrients, there are general conventions that the science has established. The forms of equations and calculations that are widely applied at any time represent only the "current best approach". Contemporary nutritionists differ to a degree on the form these models take. Thus there are different methods used in different countries and for different animal species. Students need to be prepared for the debate and changes in these constructs as new knowledge, new feed ingredients and new specifications or tolerances for nutritional requirements appear.

A problem-based online interactive learning program with a study guide, guide to tasks and supporting tutorials has been designed and used for teaching 2nd year Bachelor degree students. A key objective is to improve the problem-solving skill of each student, using this to impart a sound understanding of the biological basis of nutritional concepts and help them to adapt their calculations to suit a specific situation. A further objective is to ensure easy addition and modification as new knowledge and challenges arise in the discipline of nutrition

Program Overview

From the designers' point of view, the product 'Comparative Nutrition' is an attempt to address these issues. The unique features are:

- The tool is primarily **problem-based**, with tutorials that can be accessed and drawn on in solving problems set at a range of different levels of complexity. The student is introduced to the program through a 'Study Guide' that details the pathways that can be followed.
- The **Problems** are arranged so that the mathematical constructs that represent basic principles are explained and applied. Each Problem has a 'Guide to Task' that gives clear instructions on the process to be followed or the knowledge required. As a student progresses the 'Guide to Task' for successive problems becomes less specific or definitive of the process required.
- The **Tutorials** are developed in a matrix in which in one series, key **Concept** topics in nutrition are drawn together while in a second series the **Fact** or Content material is provided.
- The **Solutions** to most Problems will require calculations or the application of formulae or equations to values for the variables identified in the problem.
    - All calculations will be conducted in a dedicated spreadsheet.
    - If the equation or form of calculation is embedded in the spreadsheet it will be visible so all calculations are transparent.
    - Where an equation has to be imported it can be found in a Tutorial and a summarizing Table, or the student may be required to derive it from principles laid out in the 'Guide to Task'. The conceptual basis, derivation and explanation of a calculation will be found in the reference Tutorial.
    - The values of variables to which the equations or the steps in calculation are applied will be found as data either presented in the problem, obtained from **table of values** or a result of a measurement made in a practical/laboratory class.
    - The formulae in the first instance will be as general as possible to establish the broad conceptual basis of the form(s) of equation in common use.
- **Progression** in the learning program is established only by successful submission of a solution to each problem in a series.
    - The solution submitted is in some cases numerical and can be assessed automatically, and feedback given. In some cases the feedback will provide a diagnostic process that will aid in repeating the work and submitting a revised solution.
    - In other cases the student will submit a qualitative written answer requiring assessment by a tutor, with feedback.
- The Class tutor will at all times have access to the progress of each individual student, where the completion pattern and the pace of work can allow review of conceptual or mathematical difficulties with the student.
- **Student Evaluation:** Students enrolled in the subject will be set an assessment requirement to submit solutions to problems. They will, each year, be asked to complete a questionnaire constructed to identify strengths and weaknesses of the program. The principle criteria will be clarity in presentation, ease of progress and navigation and the effectiveness of the problems in elucidating the relationships between the qualitative knowledge and quantitative processes in problem solving.

Essential System Components

From the students' point of view, the main components of the system are:

Problems: These involve the calculation of the nutrient requirements of specific animals and the feeding value of certain foods in combination to create numerical results and/or written recommendations. The process by which students go about solving these problems is shown in Figure 1.

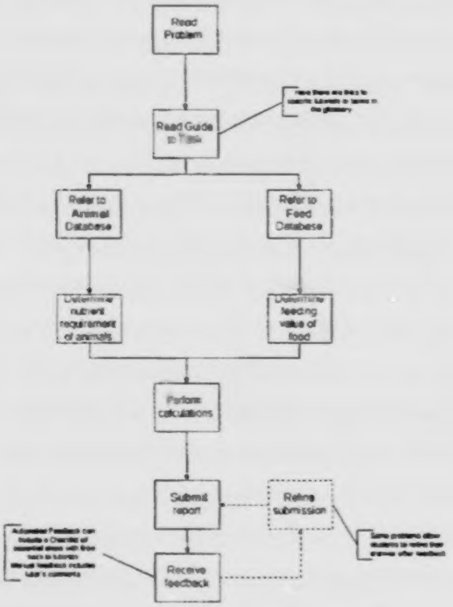
Read Problem
Read Guide to Task
Refer to Animal Database
Refer to Feed Database
Determine nutrient requirement of animals
Determine feeding value of food
Perform calculations
Submit report
Refine submission
Receive feedback

Figure 1: Process flow of student solving a set problem

The problems are divided into 'General Animal Model' and 'Specific Animal Model' problems. The General Animal Model serves to assist students master the fundamentals of animal nutrition by modelling on an animal eating an idealised food source ("cookies"). The style of the problems are either "learning mode", in which the students obtain mainly automated feedback, or "assessed mode", in which the students' work is assessed and feedback is from a tutor via the web.

Tutorials: A series of interactive tutorials has been developed and is based on a set of mini-problems. The tutorial series starts with basic concepts and becomes progressively more complex. Each tutorial session is self-contained with students working through a set of steps involving data input, calculations, and, in later tutorials, exploration and investigation.

Animals: This section includes animal species, class of animal, animal simulators (mathematical models), animal requirements calculator, and animal requirements tables.

Feedstuffs: This section includes feed components, feed analysis, feed chemical composition, nutrient classes, and a feed composition table.

Fact Files: acts as a repository for other resources such as articles, references, links, glossary and study guide.

Problem Design

General Animal Model Problem: The typical structure for a General Animal Model problem page begins with a problem statement. The 'Guide to Task' section sets out a number of steps the student must follow to solve the problem. A link to a pre-defined Excel spreadsheet allows the student to make the necessary calculations in a guided manner. In a final step the students transcribe their answers from the spreadsheet into the text areas provided within a web page form.

After students have submitted their answers, the system provides automated feedback. The students are guided to the next problem, or reminded of the essential points via a checklist, or provided with a tutorial, or put in touch with a tutor depending on their success or otherwise at answering the problem.

Assessed Specific Animal Problem: The typical structure for an assessed problem's web page begins with a problem statement. The 'Guide to Task' section sets out a number of steps the students must follow. The students must solve the problem by creating their own spreadsheet solution. The students then upload their spreadsheet files to the appropriate directory and enter the text of their report in the area provided on the web page. When they click submit, their report is stored under their own username in a database (Fritze, 2000). The tutor then makes annotations on the student's report and enters a mark using a specially designed web page linked to the same database. The student can view the tutor's comments and grade by accessing a feedback page.

Tutor's Pages

The Tutor's Home Page contains some introductory text for the tutor and links to the following pages:

Tutor's Problem Overview Page: This displays information about the problems such as the problem description, problem number, concepts, whether the problem is of type learning or assessed, and whether the feedback given is automated or manual (tutor). An icon displayed under 'Interactions/Feedback: Tutor' links to the feedback page for that particular problem so the tutor can access the students' work and provide each individual with appropriate feedback.

Progress Page: lists the students and the problems. As each student submits a problem, an icon is displayed in the student's row under the corresponding problem's column. This provides the tutor with a visual monitoring of an entire classes' progress. The student's name is linked to that particular student's overview page so that the tutor can view that particular student's work.

Implementation Process

Thirty-eight students enrolled in the subject 212-220 Animal Science 1 (Semester 2, 2001) were provided with access to the product online. During a four-week period they were set an assessment requirement to submit solutions to four General Animal Model problems. They were then asked to complete a questionnaire constructed to identify from the user's point of view the strengths and weaknesses of the program in terms of clarity in presentation, ease of progress and navigation and the effectiveness of the problems in elucidating the relationships between the qualitative knowledge and quantitative processes in problem solving. The results of the survey, yet to be completed, will be presented at the Conference. The further development of the product will be guided by regular evaluative processes.

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EXPANDING THE USER BASE OF COMPUTER FACILITATED LEARNING RESOURCES

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Abstract

This paper reports aspects of educational design that are capable of broadening the user base of a computer facilitated learning (CFL) resource. It uses as a case study the Gas Exchange Program, a self-directed learning (SDL) module originally designed to demonstrate the components and processes involved in the transfer of oxygen and carbon dioxide between the lungs and tissues. The intended users of this module were tertiary students undertaking degree courses in Medicine, Dentistry, Optometry, Physiotherapy and Science. More recently however, components of this program have been used in primary school classrooms to explain the different components of body systems and their function. Attributes of the Gas Exchange Program that have contributed to its successful transition into the primary sector are the extensive use of visually rich graphics and interactive animations, along with its modular design.

Keywords

multimedia, computer facilitated learning, problem-based learning, educational design, visual media

Background

In recent years, significant effort and funding has been directed towards the development of multimedia programs as learning resources for problem-based learning (PBL) curricula in the Faculty of Medicine, Dentistry and Health Sciences at the University of Melbourne (Keppell, Kennedy, Elliott & Harris, 2001). The Gas Exchange Program is an example of such a resource, designed to demonstrate the components and processes involved in the delivery of oxygen from the lungs to tissues, and the removal of carbon dioxide from the body. These processes are known as gas exchange. Over many years of teaching this topic, the developers of the program recognised a need for a tool that helped students visualise the components and processes involved in gas exchange. Indeed, many of the current textbooks used to teach this topic use symbols to represent these components. This provided the catalyst for creating a multimedia program that visually traced the physiological path of inhaled 0_2, and the extraction of $C0_2$.

The Gas Exchange Program is currently being used to support several of the weekly medical problems presented to 250 students enrolled in the PBL medical course. The content of the program is designed to complement second year problems about acute altitude (mountain) sickness, pulmonary oedema, asthma, and cystic fibrosis. Further details about how students use the program are discussed in "Use in a PBL curriculum" (see below). In addition, the program is being utilised as a self-directed learning (SDL) resource for revision by Physiotherapy, Dentistry and Physiology students.

This year the Gas Exchange Program was one of a number of computer facilitated learning (CFL) resources used in a pilot study undertaken in conjunction with the Australian Kidney Foundation (online) to introduce a *Kids need Health* education program into primary schools. The aim of this exercise was to educate children about healthy lifestyles, for example, the relationships between nutrition, exercise, relaxation and healthy body organs. To achieve this objective, students needed to have an understanding of body systems and their function. The Gas Exchange Program was used to demonstrate the role of the airways, lungs, heart and blood vessels in human body function. The following sections describe the educational design of this program, how it is used in both the PBL curriculum and school class room, and ends by identifying the aspects of design that have allowed it to be used in such diverse learning environments.

The Gas Exchange Program

Educational Design

The structural organisation of the program was based on the journey of inhaled 0_2 through the airways, across the alveolar-capillary membrane into the capillary where it is taken up by erythrocytes, transferred into tissues, and then the extraction of $C0_2$ produced in tissues. The journey can be summarised in five steps: Ventilation, Gas Exchange, Blood Gas Transport, Heart and Vessels, and Tissue Transfer. The components and processes of each step are explained in self-contained units. Within each of the five units content was arranged in a hierarchical order beginning with simple concepts and moving onto more complex ones.

A modular design with a structure of small, self-contained units has been advocated by Minimalist design theory to exploit people's natural learning tendency to make sense of a situation (Boyle, 1997). "Learners could then choose the units useful to support their activity, rather than being constrained to a predefined learning sequence" (Boyle, 1997, p. 13). However, to support students wishing to follow the sequence of physiological events taking place, each step was represented by a pictorial icon on the introductory page of the program. Students then clicked on an icon to navigate to a particular unit.

Rich visual effects including three-dimensional (3-D) graphics and interactive animations have been used extensively. These are mainly representational; graphics that share a physical resemblance with the object or concept being portrayed (England & Finney, 1999). On entering the program, the user views a zoom-in sequence that focuses down from a macro to a micro view of lung structures and ends with an animation of an alveolar unit. The aim of this introductory sequence was to place the processes being demonstrated in relation to body components. Zooming techniques are commonly used in visual media to draw a viewer's attention to something (England & Finney, 1999), however, they have also been used here to enable viewers to grasp the relative size differences between components.

Another visual technique employed is the use of two moving images running simultaneously side by side on the same screen. This method is used in the Ventilation unit: on the left hand side of the screen a 3-D fly-through showing a close up of the inside of the nasal passage, trachea, bronchial tube and alveoli plays. Here, the graphics have been used to encouraged students to immerse themselves in the journey and imagine that they are 0_2 moving along the passages. "The strength of graphics is to provide a visual stimulus that can trigger a reaction in the user" (England & Finney, 1999 p. 162). The adjacent graphic on the right hand side provides a more functional role by showing a macro view of the molecule's location. Because these sequences play continuously until the viewer chooses to move on, there is ample opportunity for viewers to revise the information.

Use in a PBL Curriculum

The Gas Exchange Program is currently being used as a learning resource for the second year medical problems about respiratory illnesses. Following a small group session where the weekly problem is presented online, students endeavour to formulate hypotheses about the underlying cause of the problem and the mechanism of each hypothesis. Students then undertake a period of SDL where they obtain further information to help them prioritise and decide between their hypotheses. It is during this period that students use the Gas Exchange Program.

It was planned that the program would take one hour to complete. A paper-based workbook was produced as an accompaniment. It contains exercises for students to undertake as they progress through the program. The following are examples of the type of interpretive questions and calculations: "Capillaries in skeletal muscle are about 25 µm apart. Calculate the diffusion distance ratio" (Introduction), "Why are there so many alveoli?" (Ventilation), "Explain your understanding of Fich's Law. In some diseases the A/C membrane becomes thickened. Do you think a given level of thickening would tend to have a greater effect on 0_2 diffusion into the blood or $C0_2$ diffusion out?" (Gas Exchange).

The Gas Exchange Program is also integrated with lectures and a "wet" laboratory session where students investigate the effect of relaxant drugs such as Ventolin in solution, on contracted, smooth muscle of lung. Following this period of formal and SDL, students meet to discuss the more plausible hypotheses behind the medical problem. At the week's end, final clinical impressions of the problem are made available to enable students to compare their own diagnosis and follow up, to one made by an expert.

Informal questioning of students by the developers, along with feedback from general departmental evaluation has indicated that students regard the Gas Exchange Program as a valuable resource for learning about the basic scientific principles underscoring respiratory illness. Students with no background in physics found it particularly useful. Students also liked having a workbook that they could take away with them.

Use in a Classroom

The Gas Exchange Program was used as part of an interactive session with three groups of 20, Year 6 students. To begin, the medical context of the program (why humans need 0_2, the role of the airways, lungs, heart and blood vessels in human body function) was introduced orally by a facilitator/tutor. Students were then guided through the program by the facilitator. As they observed the visual zoom-in sequences, 3-D fly-throughs and interactive animations, students were encouraged to raise questions about what they were viewing. The answers to these questions often initiated further questioning. In some cases the visuals were played many times over before students decided to move on. Each session lasted about half an hour.

The content that was shown to the Year 6 students was selected for its ability to demonstrate the learning objectives of the session (detailed above in "Background"). The more advanced material contained in the program was not included in the session. Because of the structural organisation of the program–each unit beginning with simple concepts and moving onto more complex ones–it meant that generally the first four screens of each unit were used.

To determine whether the session had successfully achieved it's educational aim of demonstrating the role of the airways, lungs, heart and blood vessels in human body function, students were asked on completion to identify something about the airways, lungs, heart or blood vessels, that they didn't know before the session. Every child was able to nominate an answer to this question, although at different levels of understanding. Student responses included knowing; the location of the heart and lungs within the body, that carbon dioxide was exchanged for oxygen (at the alveolar membrane), and the physical appearance (structure) of the heart, lungs and arteries.

The informal interactive sessions simulated a high level of interest for the Year 6 students. Student comments throughout the sessions showed their appreciation of the visual graphics. Feedback from regular teachers revealed that students continued to ask questions about aspects of the program well after the session had finished. Some of the questions raised by students included, "What would happen if eight oxygen molecules attached (to the red blood cell)?", "Why do only half the number of blood cells come out of the heart?", and "What is that thing (molecule) going away as the oxygen crosses the membrane?".

Conclusion

This case study highlights the possibility of expanding the user base of computer facilitated learning (CFL) resources beyond that of the intended target audience. The Gas Exchange Program has been used in two very diverse learning environments: a medical PBL curriculum and a primary school classroom. The style of teaching and the mode of delivery of the material were varied in each case to accommodate the different levels of prior knowledge of students. In the PBL curriculum the program was used as a computer-based, SDL resource. In the primary school classroom a facilitator guided students through the program. Although informal evaluation suggests that the learning experience of students was enhanced by the extensive use of visually rich graphics and interactive animation in the program, more rigorous evaluation is required to determine the effects of the facilitator and the mode of delivery on learning outcomes.

Significant amounts of time and funding are often invested in the creation of CFL resources. By considering the issue of transportability at the conceptual design phase of a project it may be possible to expand the final user base of a program. The re-use of learning resources in different contexts increases the number of final users of a program, and in so doing preserves the original investment of time and expense.

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STUDENT-CENTRED COLLABORATIVE LEARNING VIA FACE-TO-FACE AND ASYNCHRONOUS ONLINE COMMUNICATION: WHAT'S THE DIFFERENCE?

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Abstract

The traditional form of collaborative learning has been via face-to-face groups working together. The on-line forum can provide a different collaborative learning environment, due to its student-centric, asynchronous, written form. As a result of an investigation into the differences between face-to-face and online asynchronous communication, insights into the impact on collaborative learning emerged. This paper examines a subject that is presented using both face-to-face and asynchronous online forms of communication, discussing the differences in terms of collaborative learning.

Keywords

collaborative learning, online forum, communication

Introduction

Student-centred learning implies a "need for students to assume a high level of responsibility in the learning situation and be actively choosing their goals and managing their learning. They can no longer rely on the lecturer to tell them what, how, where and when to think. They must start to do this" (Sparrow, Sparrow & Swan, 2000). Collaborative learning environments with emphasis on process, rather than product, engender this type of interactive learning (Salmon, 2000; Ch.2). The traditional form of such collaborative learning has been via face-to-face groups working together. The online forum can provide a different collaborative learning environment, due to its student-centric, asynchronous, written form.

Structure of the Subject

Subject Details

A new subject titled "Issues for Human Communication Across the Internet" was introduced into the Bachelor of Network Computing as a third year elective in the second semester of 2000. The subject addressed issues arising from the use of the Internet as a source of human communication. It explored how human communication occurs, and investigated the Internet as a human communications medium, with particular emphasis on the World Wide Web. Students were required to critically analyse and evaluate issues that related to the Internet as a human communications medium (e.g. intellectual property rights, piracy, equity, ethics, privacy, online identity). The students looked at how the Web is used to communicate and present information for a variety of uses (e.g. electronic commerce, marketing, entertainment, education), and the various media forms that support this. Twenty-two students enrolled in the subject, with one student withdrawing from the subject during the semester. All students were studying computing, either as a single degree or as part of a double degree.

The philosophy behind the subject was that of building a collaborative learning environment with the students finding information themselves, evaluating and critically analysing the information, discussing it with one another, building structured arguments and drawing conclusions about the various topics under discussion. It used a constructivist approach, one of "learning as an active process rather than a result of transmission of knowledge from program to student" (Herrington & Standon, 2000). The main role of the lecturer was that of a facilitator.

The delivery of the subject was achieved in two forms - through face-to-face small classes and via an asynchronous online discussion forum, with the two forms covering different content areas.

Face-to-Face Classes

Each face-to-face class ran as a two-hour session once per week. The topics covered human communication, evaluation of information on the Web, the Internet as a communications medium and the use of different media forms for Web communication. Each class had 11 students.

Classes had information provided by the lecturer (this was in various forms; video and audio tapes, content from books and articles, material from the Web) and contributions from the students (usually Web sites) that illustrated the content being discussed. The students participated in discussion relating to this information and various activities to reinforce the information or promote further discussion. Discussions occurred in both small groups (three or four students) and the whole class group (lecturer included).

Online Forum

Software used for the online forum

The conferencing facility used for the online forum was Web-Board (ChatSpace, Inc.), a Web accessible conferencing forum (a web-board) with multiple conferences within that forum. The subject web-board was restricted to enrolled students and only the asynchronous medium was used.

Functional structure of the web-board

The Web-board provided a number of functions as follows:

- To provide a repository for up-to-date subject information. Three conferences were established: a "Subject Details" conference provided by the lecturer, a "Messages" conference used by students and the lecturer to post messages about the subject and a "Questions" conference where students could ask questions relating to the subject.
- To provide a set of references for the subject built by the students (about 95%) and the lecturer (5%). Students were encouraged to share interesting sites that related to all aspects of the subject topics, including those explored in the face-to-face classes. Twenty-six sites were contributed from more than half the class members.

  Students found these links useful as evidenced by the following comments:

  "I made use of these links regularly to reinforce ideas discussed during class times, to expand my knowledge and in some cases to apply what I had learnt or my ideas to a practical situation."[student 1]

  "The Interesting URL's section was again a section I used thoroughly, checking out what other people look at when researching the subject." [student 2]
- To provide a photo and personal details (contributed by the student) of each student in the class. As there were two face-to-face classes, students encountered others in the online forum they hadn't met face-to-face. This was done as part of the topic "communication of self" and as a mechanism for students to meet within the online forum. One student commented:

  "The actual student details part on the web page was interesting in finding out what other student's personalities are like. By reading through each person's profiles, I could get a better understanding of each student. This helped in the understanding of the messages and opinions each individual posted on the discussion forum." [student 2]
- To provide an online forum for discussing the issues relating to human communication across the Internet. This was the main function of the web-board. Four separate forums were run:
  - Intellectual property rights and piracy
  - Ethics, censorship, privacy and freedom of speech
  - Online identity
  - Equity

Running the discussion forums
The discussion forum on "Intellectual property rights and piracy" had a number of readings specified. A discussion was started by posing questions related to the readings and presenting a current case study on the topic centered on the organisation Napster.

For the forum on "Ethics, censorship, privacy and freedom of speech ethics" readings were also specified. Two threads for discussion were started by an audio tape of a radio broadcast that covered two current cases. These were "The responsibility of an ISP to ensure information posted is not libelous", and "The ethics of publishing information that can be used for unethical purposes and to pervert the course of justice (i.e. the Crimenet site)".

The discussion forum on "online identity" had readings embedded in the opening message that posed a number of points for discussion. An activity relating to online identity and deception was also posted.

The "Equity" forum was commenced through an activity that required the students to respond with answers online. These were summarised and a second activity for students to participate in was spawned as a subsequent part of the exploration of the issue.

Data Collection

Data comparing face-to-face with on-line communication was collected through reflective reports written by the students, a number of in-depth interviews with some students, videotaping of the face-to-face discussion, observations made by the lecturer, texts of the online discussions and logs of the access to the online forum

Results

Initially, the purpose of this investigation was to examine the differences between face-to-face communication and online asynchronous communication to improve communication in the online forum and subsequently provide a better learning environment. As a result of observations made, issues relating to collaborative learning emerged. The results summarised here attempt to highlight the differences between the two forms of communication and their impact on collaborative learning.

Student Insights

Despite students studying a computing degree and having extensive familiarity with email and the Web, most students had little, if any, experience in using online discussion forums. Half the students (10 of 21) recognised that the forum was a place for collaborative learning and that one only got out of it what one put in.

Advantages of the online forum
Table 1 lists the advantages of the forum given by the students, with flexibility of access being considered the greatest advantage. Students found this flexibility useful for both the discussion and accessing up-to-date subject information. This is consistent with other researchers who also found indications of similar advantages in flexibility (Tiene, 2000; Barnes, 2000).

Advantage	Number of responses
It is convenient in time and place	16
It is more equitable – especially for quieter students – more students participate	14
Details of the discussion remain. One can backtrack and reread a message	9
Allows the more reflective thinking student to participate more	7
The asynchronous nature allows for a more considered response	7
The lecturer is seen as a moderator rather than a teacher	4
It allowed for discussion with students from other class groups	3
The lecturer becomes just one of the group in discussion	3
More freedom and more likely to express opinions and comment on other's remarks	3
It is possible to choose what to participate in and one can multitask	2

Table 1: Advantages of online over face-to-face discussion listed by students

Disadvantages of the online forum

Disadvantages of the online forum listed by students were mainly to do with the lack of immediacy of response and lack of the interactive features of conversation that caused the forum discussion to be more constrained (see Table 2). About 25% of the students felt that too much opinion was expressed (posting only from existing knowledge) rather than structured analysis and research, and that a student's written English skills may influence their participation.

Disadvantage	Number of responses
It wasn't possible to read face-to-face nuances such as body language	10
Took away the features of conversation (e.g. immediacy of response, interactivity)	7
It was difficult to get an indication of depth of feeling or a person's response	4
Some students relied on others to post - only ? contributed in any one discussion	4
Discussion threading can become confused, allowing discussion to go off-track	3
There was a tendency not to post when in agreement	3
It is possible to opt out of the discussion, and the extended time for the discussion delays conclusions being reached or causes the topic to go off track	2

Table 2: Disadvantages of online forum listed by students

Lecturer Insights

As seen in many undergraduate courses, there were inevitably some students who were assessment driven and only posted messages for assessment purposes. Others, however, were very active. It was gratifying to see one student shifting from being assessment driven to recognising the value of the forum as a collaborative learning environment, as can be seen by the comment below.

> "I have found that there are two ways you could approach the discussion forum. You could hit it head on and make it an assessment activity where you had to post messages to gain a pass, or you could make the forum into a helping hand to the subject. … The discussion forum can be used to your benefit by taking out what you give. If you are willing to help other people then they will help you."[student 2]

The lecturer found that prompting for responses in the online forum was more difficult. Often questions were posed through the forum that received no response, and requests for contribution did not elicit an increase in postings. Despite this, some students contributed online who did not contribute voluntarily to class discussion. It was harder to motivate students to participate. Even directly emailing the student had minimal impact. At times it was difficult to keep the online discussion on track, perhaps because the lecturer was not seen as the controller of the discussion and students were inexperienced with threaded discussion forums.

Differences Between Face-to-Face and Online Communication

Synchronous versus Asynchronous Communication

Nature of response - immediate versus more considered response

The asynchronous nature of online forums lacks the immediacy of conversation, yet has the advantage of allowing a more considered response. Seven students (33%) saw the lack of immediacy of response and synchronous interactivity as a disadvantage. One student commented:

> "…being unable to get immediate feedback presented a problem….In normal discussion it is possible to ask questions in order to get a better understanding of the issue and get an immediate response."[student1]

Conversely, seven students saw the asynchronous nature of the forum allowing a more considered response to be an advantage. While some students' comments were quite spontaneous, for the most part responses in the asynchronous medium tended to be more considered than for the face-to-face discussion.

> "This communication medium also allows students to think about the discussion and research the topic before contributing to the forum, thus providing the group with a more relevant and knowledgeable response. I believe that students hate nothing more than answering a question in class and getting it wrong it is far safer to sit and say nothing." [student 3]
>
> "Another reason why I contribute [to the online forum] is because I can compose my thoughts and concepts before answering or posting a new topic." [student 8]

Permanency of content

Nine students indicated the permanency of content was an advantage, in that one didn't miss part of the conversation, and one could reflect at leisure.

> "One other thing is that the messages remain in the board where you can access it again and again if you forgot some of the points raised for those issues." [student 4]
>
> "It is good as you can keep up with the conversation if you have missed a portion."[student 7]

There was a sense that permanency also had some disadvantage, with two students commenting that this might be a deterrent to people being more active in their posting.

> "I think perhaps the reluctance to use the board was partly to do with the permanence and openness of the board." [student 1]
>
> "However, this [permanency of content] may put some people off because of the fact that the messages are stored. … [in face-to-face] even if you had said something wrong or offensive; you can always "take it back". With the online forum, you cannot do this." [student 11]

As students could remove their own messages at any time, lack of activity in discussion may have been due more to apathy or lack of willingness to explore the topic more fully than a concern about permanency.

Written Communication versus Verbal Communication

The medium of text

The medium of text did not appear to inhibit the students' use of the forum, perhaps due to students' familiarity with online communication via email. One student described the communication as "say-writing - a cross between writing and speech." She said

> "This form of communication is easy to understand, and through the use of symbols to replace the lack of physical cues, students made their best efforts to communicate effectively."[student 3]

Body language issues

By contrast, half the students considered lack of both body language and the ability to accurately assess emotion a disadvantage. The following comments were common.

> "… it can be difficult to assume the manner or tone of the conversation from one member to another, to assume sarcasm and the like, without any face-to-face contact." [student 7]
>
> " … the lack of facial and bodily expressions can contribute to limiting the effectiveness of the communication that is taking place."[student 3]
>
> "… one of the disadvantages of online discussion is that emotion is difficult to convey in writing." [student 5]

Participation

Level of participation

On analyzing the discussions it was apparent that contribution and activity increased as the semester progressed (see Table 3).

Start date of discussion	Discussion	Student postings	Number of students contributing	Number and type of postings by lecturer
24.7.2001	Intellectual property rights and piracy	17	11	9 – 2 to set up topic, 1 to set up case study, 1 to clarify, 1 to request summary, 4 to contribute
8.8.2001	Ethics, censorship freedom of speech	20	11	9 – 2 to set up topic, 2 to set up 2 case studies, 1 to pose a further question, 4 to contribute
23.8.2001	Online identity	21	12	6 – 2 to set up topic, 1 to provide reference, 1 to extend discussion, 2 to contribute
11.9.2001	Equity	22	13	8 – 2 to set up topic, 1 to clarify, 2 to summarise, 1 to curb smart remark, 2 to contribute

Table 3. Postings contribution of students and lecturer by discussion forum

Seventeen of the 21 students contributed to the forums. From the logs, all students visited the web-board to read postings, although the frequency of access varied. Level of motivation, interest in the discussion and the flexible nature of the online forum and there being no formal prompt to access the forum is likely to have causes this.

> "Having to have access to the Internet and check the site as frequently as we should have became what was sometimes a forgetful activity."[student 2]
>
> "Behaviour, willingness, interest and time management issues appear to affect participation." [student 5]

Equity of participation

Fourteen students (66%) considered the equity of participation to be an advantage with some students giving considered and articulate responses despite no class contribution.

> "The discussion forum does however encourage an equal level of participation than face to face conversation. … it got most people involved, even those people whom were reluctant to put their opinions across during class." [student 1]
>
> "… whereas in face-to-face communication, sometimes one person can dominate the whole conversation without giving the others opportunities to speak out their opinions." [student 4]

An interesting feature was that some students thought the impersonal nature of the forum encouraged responses not likely to be expressed face-to-face.

> "The downfall of the increased confidence the web board might give people is that people can also be a lot more forthright with their responses."[student 13]
>
> "… I was amazed to see how many others were against my way of thinking. I thought that my responses were just, but obviously others had different opinions."[student 12] (This last comment was from a student who was very reserved in class yet had expressed his opinions and beliefs quite strongly in the online forum.)

This agrees with Lewis, Treves and Shaindlin (1997; p.98), who found student comments to be "more opinionated and questioning, openly inviting exchange and healthy confrontation."

Group Community and Collaborative Learning Development

Collaborative Nature of the Discussion

> "In order for collaborative online learning to take place successfully, it is crucial that the learner feels part of a learning community where his/her contributions add to a common knowledge pool and where a community spirit is fostered through social interactions" (Bernard, Rojo de Rubalcava, St-Pierre, 2000, p.262).

Students recognised the online forum was about collaborative learning, as evidenced by these comments.

> "However, it's not just about sharing what *you know*, it also involves learning about what you don't know."[student 6]
>
> "I used it [the online discussion forum] more if I had an assessable task in which I needed clarification through the varying opinions and ideas suggested through the discussion at hand." [student 7]

The students did respond to one another's postings and actively discuss points, however the discussion often appeared disjointed, with points being made in isolation from others and questions posed that were never answered. The exception was the discussion relating to online identity; perhaps because students had more interest in the topic area and more personal experience of this phenomenon. This was partly due to the students' inexperience with threaded discussion that caused messages to be attached inappropriately to a particular thread of the discussion, making it difficult to follow. In hindsight, training in the use of a threaded discussion is needed.

Most discussion was generated from the student's existing knowledge rather than from further research. Conflicting responses about the depth of response in discussion occurred. Some students felt the discussion was more in depth than the face-to-face discussion -

> "I found the discussions on the web board would go into a lot more depth than those experienced in face to face discussion in class."[student 13]
>
> "If the topic really interests me, I will even go into research for that topic." [student 8]

while others felt the discussion tended to be superficial.

> "The comments made on the discussion forum were generally statements of opinion, and these opinions were not well formulated."[student 1]
>
> "... the opinions they give would be very much self centred (including me), rather than to discuss rationally about the issues". [student 3]

These latter comments coincided with the lecturer's observation that student's skills of analysis and evaluation are often poorly developed, an observation borne out by the examination results. In hindsight that more specific activities to develop these skills are needed. Reliance on the discussion alone to develop such skills is not sufficient.

Despite this, students felt the discussion opened up other possibilities for them, or gave them insights they might not have had.

> "Other students have used the board as the place to post their views on the issues that I would not have thought of before."[student 4]
>
> "The online discussion forum enabled me to read other peoples ideas, respond and reevaluate my opinion. This broadened my knowledge of the issue and helped me to better understand the issue beyond what I already knew thus constructing knowledge." [student 1]
>
> "When you read what the others have to say, their ideas and concepts become clear and you see a bigger picture."[student 6]

These comments support Bruffee's definition of collaborative learning as "a reculturative process that helps students become members of knowledge communities whose common property is different from the common property of the knowledge communities they already belong to" (Bruffee, 1993, p.3 as cited in Koschmann, 1996, p.13).

There did not seem to be a sense of reaching a conclusion about the discussion as a group, or a sense of group consensus, that would eventuate for small group discussion in the face-to-face classes. While discussion forums were started on a specific date, no fixed length of time for a discussion to run was specified, and only limited summing up was done. This caused a "petering out" of discussion. Three changes might have achieved better consensus; a fixed length of time for the discussion to run, better summing up during the forum and having students work in small groups online to present a group comment.

Lecturer-centric versus Student-centric Discussion

As has been shown in other research (Lewis, Treves & Shaindlin, 1997), seven of the students felt the online forum was less lecturer-centric than the face-to-face discussion. Perhaps this is because "online learning offers participants opportunities to explore information rather than asking them to accept what the teacher determines should be learnt" (Salmon, 2000 p.39)

> "The use of the forum changed the standard teacher guided focus of the subject that students usually expect. Although the lecturer initially introduced each topic, there was much student to student interaction."[student 3]

Observations of the face-to-face sessions showed that when the discussion group included the lecturer, the discussion was directed through the lecturer. It was as if the lecturer's physical presence caused the students to perceive the lecturer as in control. This disappeared within the online forum and students freely commented directly to one another. An analysis of the web-board content shows that the lecturer's contribution to the actual discussion, as distinct from moderator postings, was less than half the total number of postings by the lecturer (see Table 3 - column labelled "Number by lecturer").

Nature of Agreement

In a face-to-face discussion agreement is gained from the group by such things as nodding one's head and murmurs of agreement. It is possible to "actively participate without making a verbal contribution" (Barnes, 2000; p.240). This was missing from the online discussion. Students thought it redundant to post a message saying "I agree", therefore awareness of the group sense only came from those actively participating.

> "Many of the times when I had logged on there was always one student who had posted a message with exactly the same content as I would have had, this is probably why I did not post as many messages as other people." [student 10]
>
> "In normal conversation you would hear the reiteration of information presented by others." [student 1]

In the online forum, as people tend not to post to voice agreement with a comment, it is almost impossible to gauge whether others are silent because of agreement or because of a lack of willingness to post. Hence the discussion sometimes became forced.

> "My experiences on the use of the online forum and other people's use on it is that most people needed to be prompted with a negative opinion before they answer, or a contrary outlook, so that it can be countered or the idea can be enhanced through more ideas.... It seemed at times that only a few people were actively participating in discussion ..."[student 7]
>
> "I know that I have not been active in the discussion. ... But this is also because most of the things that I can think of about certain issues are already posted and basically the idea that I have is the same as what others had posted." [student 4]

Extension of the Learning Community Beyond the Forum

Despite the forum being run as one large group, the students did form their own learning communities to study and assist one another with assignments. The assignment work was very individual and all students chose quite different topics to present. The exam content showed a number of quite distinct study groups that had developed. Brandon and Hollingshead (1999) cite a number of researchers who have indicated that computer supported collaborative learning is beneficial (Alavi, 1994; Harasim, 1991; Hooper, 1992; King, 1994 as cited in Brandon & Hollingshead, 1999). It is difficult to know whether collaboration is directly attributable to the online forum or the nature of the subject, but previous experience with other subjects (even those with group assignments) did not appear to produce the same sense of community.

Conclusion

The students were enthusiastic about their experience of the online forum and felt it was an appropriate medium for this subject. The incorporation of the online forum where subject content was covered that was not discussed elsewhere encouraged greater use of the online forum than has been seen for other mixed mode subjects. The students saw advantages in the asynchronous written nature of the online forum, yet found face-to-face exchanges a more natural form of communication. It would appear that the student-centric nature of the online forum encouraged a collaborative approach to learning, and a subsequent natural development of collaboration outside the online environment. However, more research is needed to determine if this is directly attributable to the online forum rather than the nature of the subject itself.

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REFLECTING ON QUALITY LEARNING IN A STUDENT WRITING EXPERIENCE SUPPORTED BY TECHNOLOGY

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Abstract

With rapid developments in information technology in society being mirrored in the use of new learning technologies in universities, research into the quality of technologically-supported learning is essential. To date, research into new learning technologies has provided us with valuable knowledge that includes the theories behind their design, the variety of situations in which they can be applied and their impact on learning efficiency and effectiveness. Surprisingly, there has been comparatively little research from a student perspective allowing us to reflect on the quality of the learning processes. In this study, a student-focused perspective is adopted to investigate a student writing experience supported by technology. Interviews are used to reveal variation in the approaches students have adopted to the whole writing experience and the technologically-supported part of that experience. The data provides opportunity for reflection on what constitutes quality learning in student approaches to writing when technologically-supported processes are part of the experience and the results suggest important relationships that require further investigation.

Keywords
quality, writing to learn, student approaches

Introduction

Universities are embracing new technologies in curricula design to help prepare graduates for the demands of their future professional lives. Research is rapidly expanding in this area, but it is not keeping up with developments in all parts of the field. One under-researched area that requires considerable reflection is the quality of the student writing experience when technology is used to support the experience. In this study, the writing experience of students in a first-year undergraduate subject, Plant Science and Physiology (PSP), is researched. A description of the design and purpose of the technology used in that experience can be found elsewhere (Ellis, 2000). This study investigates the quality of the approaches that students adopt to the whole writing experience in PSP and the approaches they adopt when they use technology that has been integrated into the curriculum to help them to learn through writing. It then examines the relationships between their approach to the whole writing experience and the technologically-supported part of that experience and the implications these findings suggest for quality learning and teaching.

Theoretical Background and Previous Research

In the past twenty years, there has been substantial research into higher education students' experiences of learning (Entwistle & Ramsden, 1983; Crawford, Gordon, Nicholas, & Prosser., 1994; Prosser & Trigwell, 1999). Within that body of research, only a small proportion of it has focused on quality writing experiences, and little if any has considered the relationship between learning and technology. This study attempts to redress this by discussing the quality of student approaches to writing when technology supports part of the experience.

Previous student-focused learning research into writing has looked at essay planning, the quality of feedback on essay writing, meaning and context in essays (Hounsell 1984, 1987, 1997) and the process and product of essays (Prosser & Webb, 1994). This research indicated variation in the quality of the student writing experience. Some students' experience of writing focused more on the structural aspects of the experience, while a second group of students were also simultaneously aware of the referential aspects (Marton & Booth, 1997; p. 145). It is this latter group which related the writing process and product to one of meaning and it is approaches adopted by students in this group which constitute a quality approach to learning when students write. They write with the intention of making meaning and in order to do this they need to understand what they are writing. Thus they write not only to improve their written expression of their discipline, but they write to further their understanding of the content being written about. This is a version of writing to learn, an approach to education used extensively in North America since the 1970s (McLeod, 1992; Russell, 1994). The above field of research informed the reflective research approach used to investigate the learning context of this study.

The Learning Context of this Study

The learning context researched in this study is a first year undergraduate science subject, Plant Science and Physiology (PSP). Students enrolled in this subject were required to complete a scientific writing portfolio. The portfolio comprised eight writing tasks which were completed at regular intervals throughout the term. The students were expected to start with shorter tasks, which gradually became more demanding as the term progressed. Their complexity increased not only in terms of length (between 300 and 1000 words), but also in terms of content and purpose. The content addressed in the tasks included cell biology, plant nutrition, the domestication of plants, the structure of genomes, DNA, Plant Growth and Development. The purpose of the tasks varied, including genres of explanation and description, to more demanding ones of discussion and exposition. By completing regular shorter texts than the typical end of term essay, the design of the portfolio allowed for a greater focus on the writing process. Students received more systematic feedback on each of the eight tasks than they would have received from one or two longer essays.

To help the students engage in the process, a scientific writing database was introduced into the curriculum. This database comprised around 300 texts and text segments which were used as models and one type of feedback in students writing processes. The contents of the database were moderated, annotated and edited versions of previously enrolled student texts. The database was networked and combined with a bulletin board to allow asynchronous collaboration amongst students and with the lecturers. Together the technology is referred to as the PSP Interactive Learning Environment (PSPILE) (Ellis, 2000)

Students could begin preparation and writing of the portfolio tasks either before or during the related tutorial. A typical student writing process of students in this subject would involve receiving feedback from the previous writing task, analysing a textual model, completing modeling exercises in the database that foregrounded specific referential and structural concepts, collaborating with other students (either in class or asynchronously) and then individually writing their texts. Thus the relationship between their writing experience and the technologically-supported part of the experience can be represented as shown in Figure 1.

For students in PSP, approaches to the whole writing experience meant the approaches they adopted in tutorials, workshops and lectures, while the technologically-supported part of that experience referred to those instances when they used the PSPILE in their writing processes. To investigate the student writing experience, 22 interviews were conducted out of a cohort of 51 students. The interviews were completed at the end of the semester after the students had experienced writing the scientific portfolio tasks. They were 20 minutes in length and fully transcribed.

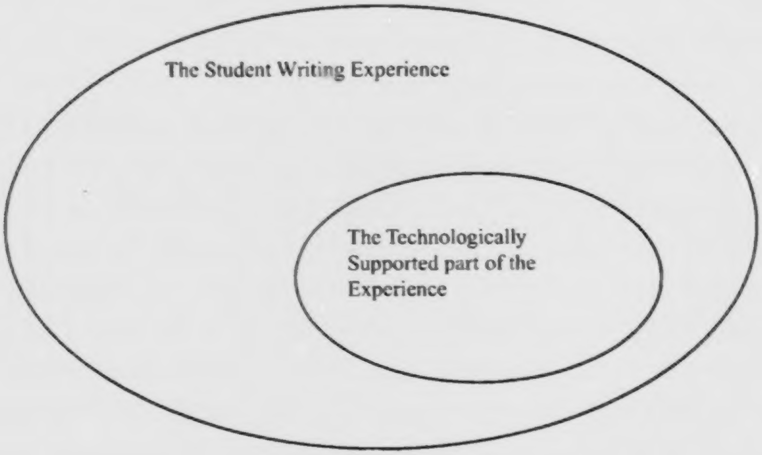
The Student Writing Experience
The Technologically Supported part of the Experience

Figure 1: The relationship between the whole student writing experience and the technologically supported part

The Research Questions Addressed by the Interview Questions

Research questions consistent with the model of learning described above and addressed by the interviews were:

1. What are the categories and distributions of approaches to writing for students in Plant Science and Physiology?
2. What are the categories and distributions of approaches to technologically-supported writing process for students in Plant Science and Physiology?
3. Are there relationships between any of these elements of the student experience of writing?

In order to research these questions in the learning context, an interview process was developed. To increase the reliability of the results of the interviews, the process and questions were designed to be consistent with previously published methodologies used to investigate student learning (Crawford et al.,1994), expert advice was sought (Prosser & Trigwell, 1999) and the interview process was trialled on three students. As a result of the trial, the wording of the questions was tightened and the familiarity of the process allowed the interviewer to focus more on the students interviewed in the main study to probe the meaning behind their responses.

In a phenomenographical approach to researching student learning, categorization of the approaches used by students in the learning experience are an integral part of the study. The following begins with the student approaches to the whole writing experience revealed in the interviews.

Interview Extracts Of Student Approaches To Writing in PSP

The questions used in the interview to investigate student approaches to writing were:

What was your approach to writing in PSP and why did you approach your writing that way?

The question above asked students to reflect on their approach to the whole writing experience of PSP, writing in the lectures, workshops and tutorials. The extracts from interviews discussed here are from students who represent the categories of approaches that students brought to writing in PSP.

Approach 1

When asked about his approach to writing in PSP, Brad replied:

> "I would research, source all the information, put it in point form and then transform that into the actual essay. I just put them straight onto the computer, that's my style and then go through

> and check it. I would check the spelling and grammar."

When pressed to explain further about his approach to writing, Brad replied:

> "It has a definite introduction, a body explaining it and then there is an end…I put it through the spell checker and the grammar checker at the end, but that's all."

When Rebecca asked how she approached her writing in PSP, she replied:

> "I tried to take out the main ideas in the books and I wrote down the main ideas… and later I wrote a draft incorporating the notes from the lecture."

When asked how she organized the ideas, Rebecca replied:

> "I decide which one comes in the first part and which in the body and which in the last part."

When Rebecca was asked to explain what she meant by "part", she replied:

> "I mean the section of the report".

Approach 2

When asked the same question as the previous students, Damian replied:

> "I'd try to get some kind of structure and then I'd go through and write a paragraph and see how it sounded if it was alright, or if I was having troubles with it, I'd come back later."

When asked what he meant by "come back later", Damian explained:

> "I'd go through and try to pull apart my own work and see what I'm doing wrong… checking all the information was there"

When asked why he was revising, Damian added:

> "Well mainly (for) the marks, like I'd look at well, what does the lecturer want and okay, how can I best fulfil requirements."

Asked how she approached her writing, Kieran replied:

> "Yeah I would change stuff….When I write off the top of my head it doesn't always make sense."

Asked what she was changing, Kieran responded:

> "Grammatical (things) mostly but sometimes the information is around the wrong way."

Approach 3

When asked how she approached her writing, May replied:

> "Well first of all for academic tasks I'd go through the modules that were related to that task. Read through all of those, make notes as I went. Read through whatever notes I've made in the lectures, then I'd read through the relevant chapters, try and summarise those and pull out the most relevant points on those.

When asked what she did after her preparation, May continued:

> "Once I've got all the information down and I understand what's going on, then I just sit down and write it...and make sure it all makes sense and I do understand the Science as I'm going along."

When asked about his approach to writing, Col replied:

> "I'd go away and read up some text books and lecture notes, and then I'd start doing a draft and see how that pans out, read through it and just keep going back to what is the model and what sort of things are expected"

When asked what was the most important aspect of his approach to writing after completing his preparation, Col replied:

> "Revising for making a better writing task and also so you can improve the Science and understand the Science better".

Student Approaches To the Whole Writing Experience in PSP

The above quotations differ in their structural and referential aspects. In referential terms approach A foregrounds grammar, spelling, structure, as does B. However B also foregrounds a task awareness evident in the focus on marks and an intention to "pull apart" the work or "change things (when the) information is around the wrong way". In contrast, approach C foregrounds an intention of acquiring scientific knowledge and how to express that knowledge appropriately when writing. There is a qualitative shift in the intention of the students between approaches B and C: moving from learning to write for the purposes of completing the task, arranging information, and checking textual features, to writing to acquire knowledge about the science and its written form.

In structural terms, approach A is characterized by checking the grammar and spelling and checking the structure. Approach B emphasises the completion of the task and arrangement of information as well as checking the surface features of the text. Approach C emphasises a growing understanding of the science and an understanding of how to express the science appropriately.

The above referential and structural aspects of student approaches to writing in PSP describe the variation in the student writing experience (Marton & Booth, 1997; p. 145). The three qualitatively different categories of description exemplified by the above extracts from the interviews are:

Category	*Description*
Approach A	Writing to copy and check structure grammar and spelling
Approach B	Writing to complete the task, arrange the information and use appropriate language
Approach C	Writing to understand the science and to express it appropriately

Table 1: Student approaches to the whole writing experience in PSP

Referentially, approaches A and B separate understanding the content from the writing process and are therefore multistructural. In contrast approach C is a relational one, one which approaches writing as a way of understanding the content and how to express it appropriately. Structurally category B is inclusive of A, and C is inclusive of B and therefore empirically inclusive. This means students in category B also have strategies of A at their disposal and students in C have strategies of B at their disposal.

In the interviews, students were also asked to focus on the technologically-supported part of their writing experience in PSP. For them, this meant that they had to reflect on how they used the scientific writing database (which included use of a word-processor) and the writing preparation tasks using the bulletin board. The following outlines the interview segment that dealt with these experiences.

Interview Extracts Of Student Approaches To Technologically-Supported Writing in PSP

The questions used in the interview to investigate student approaches to the technologically - supported part of the writing experience were:

> *What was your approach to writing with the technologies we used in the tutorial, and why did you use the technology in that way?*
>
> *What did you use the bulletin board/database/word processor for and why did you use them in that way?*

The extracts from interviews discussed here are from students who represent the categories of approaches that students brought to technologically-supported writing in PSP.

Approach 1

When asked how she used the technology in the writing process, Rebecca answered:

> "I used the word processor to write my portfolio…I used font and size and other stuff like spacing.

When asked about the other technology she might have used and why she used it, Rebecca replied:

> "I used the bulletin board to access other students, like, information or staff that we did in the tutorial…I saw samples of what other students did and how they did it and get some ideas from them…like grammar."

When asked about his approach to using technology in the writing process in PSP, Danny replied:

> "The database I just used as a source to copy, just to look at, and structure-wise I started to do some more to it and it just gave me ideas, how it was supposed to be structured, which way you take it."

When asked about the use of the other technology and why he used it, Danny replied:

> "The database is good for answering questions, but all the factual information, you're better just to read the textbook."

Approach 2

When asked about his approach to using the technology in the writing process, Damian answered:

> "Like after I've written a bit, I'll go back to the (database) exercises, like the points you need to find in the exercises, in order to put a writing portfolio task together".

When asked why he was doing that, Damian continued:

> "I was trying to improve my marks."

When asked how he approached the use of the technology in the writing process, Steven responded:

> "I used it (the database) a couple of times. I remember one of the exercises was repeating the words that we had so instead of starting the same sentence with the same sort of things, I looked at different ways of writing a sentence…the other ones were posted there…just helped me improve my writing."

When asked if the database and its models helped Steven learning anything else, he added:

> "Oh I suppose the science as well…so I made sure I had everything right for the assignments".

Approach 3

In contrast and in response to how she went about using the technologically-supported writing processes, May said:

> "Um it (the database and its exercises) just made me realize where I was at with my sort of writing and listen to a few ideas of how to go about things. And the exercises yeah, helped you get to the point, get to the fact, get the science organized and express it in a good way and get the focus happening and stuff like that."

When asked to expand on her answer, May replied:

> "It helped me clarify what the science was in the first place and what it was exactly that we were going to be writing about."

When Col was asked about his approach to using the technology, he said:

> "Well mainly I used the technology on the database with regards to the writing task.

When asked how and why he used it, Col replied:

> "It helped me understand (the Science) a lot better because you've got a bit of a guide there and you also, because you're revising it more often."

Student Approaches To the Technologically-Supported Part of the Writing Experience in PSP

The above quotations in the three categories of approaches to technologically-supported writing in PSP differ in their referential and structural aspects. In referential terms approach A reveals the intention of using the bulletin board to check the grammar of the other students, using the database to copy and check the structure of the other students. Approach B reveals the intention of using the database to find the "points you need to find", in other words, collecting information for the purpose of improving marks, and using the database to improve expression. When a student does mention learning the science, it is for accuracy in the assignments, rather than quality of understanding. Approach C reveals a qualitative shift from the previous categories. This category reveals an intention of using the database in ways which "clarify what the science is" and understand it a "lot better". An intention to understand the science underpins the use of the technology when it supports the writing process.

In terms of the structural aspects of the quotations, approach A emphasises collecting, copying and checking as strategies when using the technology, approach B emphasises completing the task, improving expression and using the technology to become more aware of appropriate language. Approach C emphasises developing an understanding as the strategy behind the use of the technology: both of the science and its written expression.

The patterns in the data about the student approaches to technologically-supported writing in PSP suggest the following categories:

Category	*Description*
Approach A	Using technology to collect information, copy and check structure grammar and spelling
Approach B	Using technology to complete the task, improve expression and use appropriate language
Approach C	Using technology to understand the science and express it appropriately

Table 2: Student approaches to the technologically-supported part of the writing experience in PSP

Looking at table 2 and table 1, the logical relations between the categories are apparent. They do not map exactly as their categorisation is a product of the awareness of the approach in the population of the PSP students. However, it is clear that category A of the whole approach is very close to category A of the technologically-supported approach, and a similar pattern is found between the other corresponding categories. An interesting question that is prompted by this analysis is the relationship between the approaches adopted by individual students and the relationship between their approach and performance.

The Relationship Between the Approaches Adopted by Students In the PSP Writing Experience and Performance

The categorisation of the interview data suggest relationships between the approaches students adopted to the whole writing experience, and the technologically supported part of that experience. The categorisation of the approaches apparent in the data from the interviews is shown in the table below.

Number Interviewed	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Student no.																			
Category	9	8	51	29	12	22	48	21	1	28	24	25	38	39	44	13	43	11	20
Approach to Writing	C	B	C	C	B	B	B	C	B	B	B	B	B	B	B	A	A	A	A
Approach to technologically-supported writing	C	B	C	C	B	A	A	B	B	B	B	B	A	B	B	A	B	A	A

Table 3: The variation in the student approaches to writing in PSP revealed in the interviews

The table above shows the categorisation of student approaches in the writing experience. The letters correspond to the categories of the outcome space of the approaches, and the arrows indicate the tendency towards another category indicated by the data. An arrow to the left indicates a tendency to a more complex category and an arrow to the right indicates a tendency to a less complex category.

The relationship between these results can be determined by grouping the categories. Surface approaches, categories A and B separate an understanding of the content from the writing process and as such are a multistructural awareness of the phenomenon of writing. Category C, which is a deep approach, has the intention of understanding the content as part of the process and is a relational awareness of the phenomenon of writing. The distribution of the relationship between the whole and technologically-supported approaches to writing in PSP are shown in table 4. To assess whether or not the distribution of student responses as shown in the table were statistically significant, a phi coefficient was calculated and a fisher exact procedure was used. The fisher exact procedure of testing the statistical significance of phi coefficient is preferably used when the population is small and/or one of the numbers in the 2x2 table is less than 5.

Approaches to Writing in PSP Indicated by the Interviews		*Whole Approach to Writing in PSP*		*Totals*
		Surface Approaches *Categories A & B*	Deep Approaches *Category C*	
Technologically-supported part of the writing experience in PSP	Surface Approaches *Categories A & B*	15	1	16
	Deep Approaches *Category C*	0	3	3
Total		15	4	19

phi = 0.7, p<.01,

Table 4: Relationship between approaches to the whole writing experience in PSP and the technologically-supported approach to writing

The phi coefficient for the above table is 0.7 which indicates a strong positive relationship, statistically significant at p<0.01. These results indicate that students who adopted one approach to the whole experience, tended to adopt a similar approach to the technologically-supported part of the experience.

Table 5 indicates that students with a deep approach to the whole writing experience and the technologically-supported part of that experience tended to achieve at a higher level according to their writing mark. Students who adopted a surface approach had a mean writing mark of approximately 10, while students who adopted a deep approach had a mean writing mark of approximately 15. These are large effect sizes according to Cohen (Cohen, 1977).

Approaches to writing	Plant Science and Physiology, Portfolio Writing Mark	
	#Mean	SD
Whole Approach		
Surface	10.4	3
Deep	15.1	3
T test: *T* =	3.0*	
Technologically supported approach		
Surface	10.5	3
Deep	15.9	3
T test: *T* =	3.1*	

*p<0.01, # Writing Mark out of 20

Table 5: Relationship between approaches adopted and the writing mark

Directions for Research Suggested by the Results

This study is part of a larger study which involves other quantitative and qualitative methodologies to triangulate results. The 19 interviews used here are an intensive approach to mapping the approaches students adopt to writing in PSP. While valuable for their intensive nature, the interviews have mapped only 37% of the population. An extensive study using an open-ended questionnaire and closed-ended questionnaires capturing a larger percentage of the population is also being analysed, so that the relationships that appear in the interview data can be investigated to see if they are triangulated.

With the qualification of the above paragraph, the results in the above table provide valuable knowledge for reflection. The research indicates that when designing interactive learning environments for quality learning outcomes, teachers need to consider more than design and evaluation issues about the quality of the technological environment. Quality learning outcomes are related to how students use the technology. In PSP, there is variation in how students used the technology and this variation appears to be related to their approach to the whole writing experience.

Students who adopted a surface approach to the whole writing experience in PSP, one which did not foreground an understanding of the content in the writing process, tended to adopt a surface approach to the technologically-supported part of that experience. Students who adopted a deep approach to the whole writing experience, that is they sought to understand both the science and how to write the science during the writing process, approached the technologically-supported part of the experience in a similar way. These results suggest that when technology supports part of the learning processes as it does in the PSP writing experience, then quality approaches to technologically-supported learning are related to the quality of the approach the students adopt to the whole experience. If we wish to help PSP students adopt quality approaches to learning through writing when they use the technology, then helping them to improve the quality of their whole approach is likely to have positive results in the quality for their approach when using the technology.

The quality of learning outcomes when technology is involved is an important area for reflection. Developing sound research methodologies to investigate the quality of learning experiences is a worthwhile outcome of research in this period of rapid integration of learning technologies into curricula.

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THE BRISTOL BIOMED LEARNING AND TEACHING PROJECT: PROMOTING EFFECTIVE USE OF IMAGES IN BIOMEDICINE

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Abstract

This paper describes the activities of the Bristol BioMed Learning and Teaching project (BB-LT). The paper will focus on how in response to feedback from users and contributors the project grew out of the successful Bristol BioMed Image Archive. It was identified that, to exploit the visual and cognitive impact of an image fully, there is often a need to embed the image within a specific context, and to integrate it with pedagogical aims and strategies. BB-LT was developed with the specific aim of providing an enabling framework to support the use of Bristol BioMed images in learning and teaching.

Keywords

images, digital images, image banks, learning, teaching, case studies, medicine, dentistry, veterinary medicine

Images in Learning and Teaching

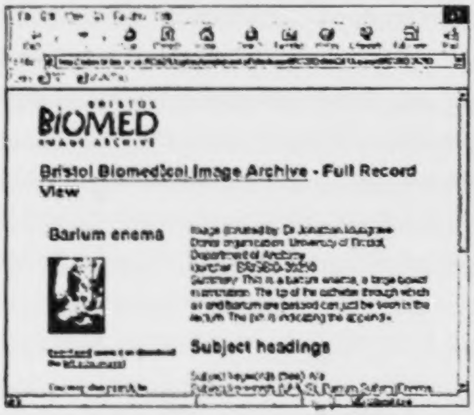
There is widespread recognition that we live in an increasingly visually-oriented society; one in which textual representation no longer has to be the dominant paradigm for information and instruction (Armitage & Enser, 1997). Use of high-quality digital images can add a new dimension to the learning and teaching experience, bringing new opportunities and challenges for teaching and assessment. Images provide access to complex visual information and experiences that cannot be replicated in purely textual terms: "Pictures interact with text to produce levels of comprehension and memory that can exceed what is produced by text alone" (Levin, 1989).

Levie and Lentz (1982) found that users prefer, and value more highly, material which contains visual elements. The processing of visual information involves the engagement of both senses and cortical skills which, it has been shown, can promote deeper learning and recall (McAteer & Shaw, 1995). Additionally, images are intrinsically evocative and associative, stimulating imagination and creative thinking. Research has shown that, providing images are meaningful, the brain capacity for recognition memory for pictures is limitless (Freedman & Haber, 1974). Images have a direct route to long-term memory, storing information as discrete concepts (Paivio, Rogers & Smythe, 1968). These concepts, or structures, are reorganised as new information is received and processed, leading to a more profound and precise understanding (Bobrow & Norman, 1975; Rumelhart, 1980).

The Bristol BioMed Learning and Teaching Project

The Bristol Biomedical Image Archive (Online) is an established, successful Web-based collection of over 8500 biomedical images that can be freely used to support learning and teaching. Having created a successful digital image service, the next stage for Bristol BioMed was to investigate how use of the archive to support learning and teaching could be developed and promoted. As

Stebley (1998) notes, "To really understand the framework of implementing new technologies and resources, one must first have an understanding of what users require and why they will use it".



BRISTOL
BIOMED
IMAGE ARCHIVE

Bristol Biomedical Image Archive - Full Record View

Barium enema

Subject headings

Figure 1: Catalogued image in the Bristol biomedical image archive

To try to discover what Bristol BioMed users want in terms of support for learning and teaching activities, a survey of archive users was carried out, including selected follow-up interviews, and a focus group of users was held at the University of Bristol. Responses and discussion outcomes indicated that, to exploit the visual and cognitive impact of an image fully, there is often a need to embed the image within a specific context, and to integrate it with overall teaching aims and strategies. The Bristol BioMed Learning and Teaching Project (BB-LT) was developed with the specific aim of providing an enabling framework to support the use Bristol BioMed images in learning and teaching.

BB-LT (Online) consists of inter-linked learning and teaching resources based on Bristol BioMed images. These include tutorials, case studies and how-to guides, which together provide a coherent strategy for the use, evaluation and integration of the archive images with mainstream teaching activities. As Laurillard (1993) recognises, learning is dependant on prior knowledge and experience. Therefore it was essential that resources were authored by experienced practitioners with an understanding of how the content of the resource would map onto students' existing knowledge.

Resources Development

Authors were encouraged to take a simple, pragmatic approach to tutorial construction, using readily available tools and techniques. Take-up rate for digital resources is likely to increase if it can be shown that simple, easily replicable materials can be effective, quick and easy to use, and cheap to create and deliver. It has been noted that many commercial CAL packages are so complex that they can appear daunting to students; short, easily-completed tutorials dealing with clearly defined topics may be easier for students to use more effectively. (Jones, Greenwood, Edwards, McCulloch, Tobias & Nicholson, 1998).

It was recommended that authors should develop resources that would not merely duplicate a traditional lecture or tutorial in electronic form, but take advantage of the medium and its potential for interactivity and visual impact to deliver elements a standard tutorial could not. The ultimate aim was to make learning visually stimulating, however, images should not overwhelm the material to the extent that learners focus on visual elements rather than engaging with content. Reeves and Nass (1996) note that the size and visual characteristics of an image all affect mental processing. For example, larger images have been shown to result in stronger memory retention and more positive perceptions of the content received.

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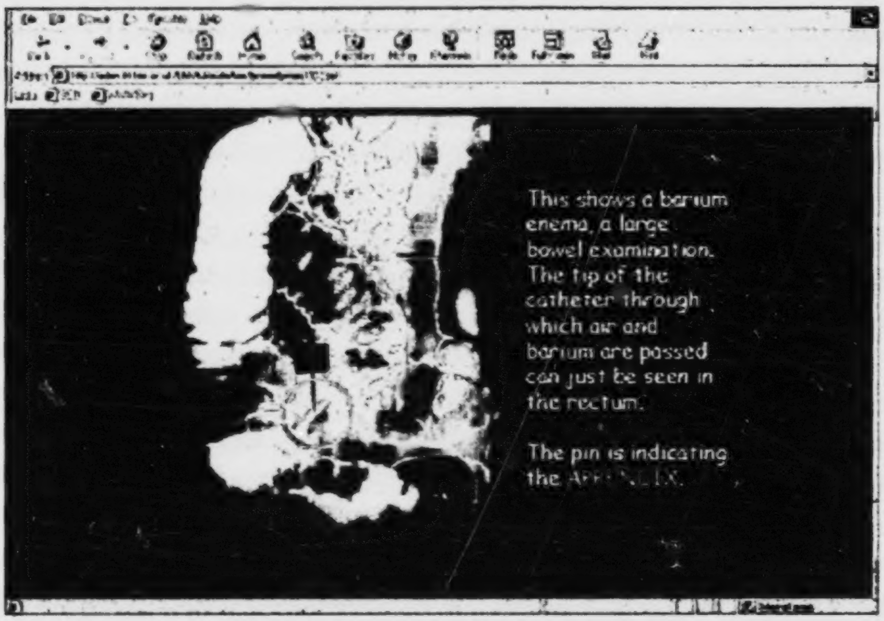

This shows a barium enema, a large bowel examination. The tip of the catheter through which air and barium are passed can just be seen in the rectum.

The pin is indicating the APPENDIX.

Figure 2: Image from figure 1 within a PowerPoint tutorial

All materials may be freely downloaded and can be used in a variety of ways: to reinforce teaching points, to give supplementary information, to check the accuracy and depth of knowledge, to encourage a better understanding of difficult topics, to review knowledge and revise for tests, for independent or class-based learning, for self-paced learning. They are relevant both to primary teaching and reinforcement. The tutorials demonstrate examples of different learning situations and modes, for example, problem-solving, integrating diverse sources of information, synthesising abstract ideas and concepts, and reflection.

Case studies document each author's experience of creating tutorials with Bristol BioMed images. The studies include details of software, tools and techniques used, problems encountered and how these were overcome, as well as details of how to reproduce the tutorial. They provide an insight into the costs, benefits and feasibility of creating and using the BB-LT resources and in particular how they can enhance the learning experience, in addition to providing a critical reflection of the lessons learnt. As well as providing examples of best practices by practitioners in the field, the case studies have also been of value as part of the quality procedures by providing a reflective account and review of the integration process.

Conclusion

There is clearly a need both for resources which bring high quality digital images together, and for resources which demonstrate how those images can best be used in learning and teaching activities. When designing and developing computer-based educational resources, there is a need to consider both user-computer interaction and learning theory. It is important to plan materials carefully, considering learning objectives and integration with the curriculum. Failure to do so will render the resource unreliable, irrelevant and unlikely to be used.

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FILTER: FOCUSING IMAGES FOR LEARNING AND TEACHING – AN ENRICHED RESOURCE

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Abstract

Digital images have a rich potential as learning and teaching resources and are currently under-utilised in the support of pedagogical activities. The FILTER (Focusing Images for Learning and Teaching – an Enriched Resource) project is addressing this under-use and encouraging uptake of visual resources by mapping different types of images and defining the ways in which those images can be used to enhance the learning and teaching process. These categorisations form the basis of the main project deliverables: a generic image dataset, a set of subject-specific image datasets and supporting documentation such as "how-to" guides and case studies. This paper describes the aims, objectives and methodologies of the FILTER project. The project is based at the Institute for Learning and Research Technology, the University of Bristol, and started in May 2001.

Keywords
images, digital images, learning, teaching, cross-disciplinary, collaboration

Introduction

It is known that a high level of expertise in image use already exists in certain subject areas, but possibly using a limited range of image types. However, as Williams, Lock, Crisp and Longstaffe (1995) have noted, there is currently no extensive body of information exploring the use of images in computer-based learning and teaching.

As more and more images become available over networks, it is crucial to take a collaborative approach to developing common standards for the creation and use of digital images (Hastings, 1999). The FILTER project (Focusing Images for Learning and Teaching – an Enriched Resource) is working closely with a number of Learning and Teaching Support Network (LTSN) subject centres to investigate aspects of image use in learning and teaching. The LTSN is a network of 24 subject centres based in higher education (HE) institutions throughout the UK. It aims to promote high quality learning and teaching through the development and transfer of good practices in all subject disciplines. The LTSN subject centres have an established direct route of communication and dissemination to practitioners, enabling FILTER to enter into dialogue with subject specialists in order to inform research processes and outcomes directly.

Each LTSN has varying levels of experience of image use; FILTER aims to enable a cross-fertilisation of these varying knowledge levels across subject disciplines, so that there are multiple learning opportunities for all involved. Transferral of expertise has a major role in the development of the main project deliverables: a generic image dataset and a set of subject-specific datasets containing: images, examples of image-based learning and teaching materials, supplementary thematic how-to guides and supporting metadata. This collaborative approach permits the identification and exploration of the factors of image use that are common to a number of subjects. Synthesis of this cross-domain knowledge sharing in the form of an exemplar database containing the image datasets will ensure maximum benefit to the widest possible potential HE and further education (FE) user-base.

FILTER's goal is to educate the tertiary education community on the potential for image usage; project research will focus on developing a better understanding of the use of images in learning and teaching. The project will provide case studies and exemplar digitisation and supporting materials to directly inspire usage of images in learning and teaching, with particular emphasis on subject areas where the use of images is comparatively underdeveloped and unexplored. Differences in learning and teaching styles across disciplines are well documented (Becher, 1989, 1994; Neumann, 2001). FILTER is investigating the ways in which these disciplinary differences affect perceptions of images and how they are currently used. By choosing a wide range of disciplines to research, FILTER aims to show that this work is applicable across subject areas and that therefore it will benefit learning and teaching in all subject domains.

Images in Learning and Teaching

It is known that learning is deeper and more effective when multiple senses are engaged in the learning process (McAteer & Shaw, 1995). It is also commonly accepted that users prefer and respond more positively to materials that contain visual elements (Duchastel & Waller, 1979; Levie & Lentz, 1982). Much research has been carried out establishing that recall and memory is improved when information is presented visually, or supplemented by use of images (Paivio, Rogers & Smythe, 1968; Standing, Conezio & Haber, 1970; Paivio, 1971, 1975; Standing, 1973; Faraday & Sutcliffe, 1997). However, it has been identified that there is a gap in the understanding and documentation of how to make the best use of images within learning and teaching materials (Williams et al., 1995).

Images are vital in our perception of the world: sight is primary among our senses, visual images have an impact and an information value that is unparalleled. The word 'image' is, in a sense, deceptive; a little reflection illustrates that there is, in fact, a significant number of different types of 'images' or pictorial/graphical representations.

FILTER is defining different image types to make the ways in which images can be used to support learning and teaching more transparent. In order to make the most appropriate use of images in educational materials and to greatly enhance the learning and teaching experience, the community must understand the different types of image available. However, academics outside disciplines which have typically used images widely may not always have the skills and perceptions which would allow them to make most effective use of visual data. This is particularly true of subject areas where images are not embedded in the learning and teaching process: images are traditionally an integral part of teaching in subjects such as the Visual Arts, Medicine or Built Environment, whereas teaching in Humanities subjects tends to be predominantly text based.

It is also important to note that in some subject areas images and their related taxonomies are clear aspects of scholarly practice, for example, the Medical Subject Headings scheme, or MeSH (U.S. National Library of Medicine, Online), in the biomedical disciplines. In others this sense of categorisation and taxonomy is less well developed. A key part of the project will involve developing an understanding of image usage and its function among different subject areas. The project clearly recognises that the notion of appropriate image usage must be driven by subject experts in order to inform and develop categorisations.

FILTER Approach

Timescales

In the first year, the project is working closely with a core set of LTSN subject centres. The subject centres have been commissioned to produce subject-specific image datasets and associated how-to guides and case studies, potentially choosing image types defined by the initial generic image set.

Activity	Jul Aug 01	Sep 01	Oct 01	Nov 01	Dec 01	Jan 02	Feb 02	Mar 02	Apr 02	May 02	Jun 02	Jul 02	Aug 02
Contract metadata specialists													
Database investigation													
Develop guidelines for generic dataset													
Investigation of image types													
Investigation of metadata													
LTSN focus group													
Research and literature review													
Web site development													
Consultative Forum													
Database development													
Draft generic dataset													
Focus group meeting													
Delivery of metadata report													
Final generic dataset													
Produce focus group report													
LTSN workshop													
Development of LTSN datasets													
Metadata schema/guidelines developed													
Database drafted													
Draft LTSN dataset due													
Usability testing of database													
Development of criteria for further sets													
Edit and return LTSN datasets													
Delivery of LTSN datasets													
Workshop with LTSNs													
Commission further 10 datasets													
Deliverables into database													

Figure 1: FILTER Project – timeline by activity start date, July 2001-August 2002

Also during this phase is the development of standards and methods for providing descriptive, subject-specific and learning and teaching-related metadata, which will enhance retrieval and ease-of-use of datasets. The final stage of this phase of the project involves the collation of the subject-specific image datasets and all associated materials such as the "how-to" guides, case studies and metadata, plus the generic image dataset, to form an exemplar database of image types and their use in learning and teaching.

In the second year a further ten sets will be commissioned across the broader subject areas. A general call out to the wider community, via the LTSN, will invite submissions for further subject-specific image dataset developments according to the criteria derived in the first phase. Priority at this stage will be given to datasets that fill a clear gap in subject area or type of image represented. In this way the project will be able to generate a comprehensive presentation for image use of relevance across the sector, underpinned by a cross-fertilisation of ideas and expertise from subject area to subject area. This also demonstrates that the project is a scaleable concept and could be expanded to commission more resources.

During the second year the contents of the exemplar database will be accessible via a number of routes: from the Technical Advisory Service for Images (TASI) Web site (Online), and also from the LTSN subject centre Web sites. Workshops and training activities will demonstrate how LTSNs catering for other subject areas could apply the models and materials developed. Primary participants will be LTSN representatives, but could also include interested parties from the wider tertiary education community.

Key Issues

The overall project aims are to enable the use of digital image datasets to support learning and teaching and to facilitate the integration of image resources with pedagogical practice. The project will provide a valuable mapping of images that will facilitate uptake in the use of visual data in educational contexts. Equally important, this type of mapping will help to provide a model of good practice by indicating appropriate use of different image representations coupled with the production of exemplar subject-specific image datasets.

The key research issues for the project are:

- Under use of images to support learning and teaching
- Inconsistent and uninformed use of images in some disciplines
- Lack of understanding of educational image use

When focusing on possible reasons for the current under use of images in an educational sense, there are three main considerations that arise:

1. There is currently no clear picture of the different categories or types of images that exist and how they inter-relate
2. There is little documentation of the ways in which these different categories of images can be used. For example, when might it be more appropriate to use a two-dimensional schematic map as opposed to a digital 'photorealistic' image? When is a real-time representation more informative than a series of stills? How much difference does a full colour image make as opposed to a simple grey-scale version? Decisions such as these are currently made intuitively, rather than against a set of clear criteria. Furthermore, appropriate use may be a simple decision for an "imaging expert", but as images become more widely used by a larger percentage of the teaching population, clearer guidelines are needed
3. There is a need for documentation of the ways in which images are being and can be used to support learning and teaching mapped against the different categories of images

Data Gathering

A critical element of the initial project research is the investigation and establishment of standards for issues underlying the creation and use of image databases: technical infrastructure, metadata schema, and best practice for image use. It is important for the project to gain as much comprehensive, diverse information on and insight into the issues surrounding current academic image use as possible. As well as reaching those who typically make high use of images, and have the technical skills and access to equipment that permit this, it is also crucial to reach those who make less use of images, for whatever reason. Therefore, project data is being collected in a number of ways, via a number of different routes that will allow the project contact with a range of practitioners.

Focus Groups

During the initial stage of the project, representatives from the LTSN subject centres attended a preliminary focus group that aimed to identify the different types of images that were currently being used (e.g. photographs, diagrams, schematic representations), and any commonalities in image use between disciplines. The list of image types derived from that meeting provides the foundation for an initial mapping of image categories and the ways in which they can be used to support the learning and teaching process.

The draft image map and generic image dataset will be taken to a practitioners' focus group, bringing together key people within the community, from various subject disciplines, who are leaders in using all types of images within a learning and teaching context. The aim of this meeting is to discuss the categories and types of image (whether digital or not) that exist and to gain knowledge of how these images are currently being used in academic environments. The outcomes of these discussions will inform the refinement and definition of the draft generic image categorisation map, which subsequently will be supplemented by a number of subject-specific adaptations. The latter will include examples of the ways in which each category of image is used in learning and teaching. From this it will be possible to discern what roles different types of image perform, or have the potential to perform, in specific subject areas and what support is needed in the community to encourage the usage of other image types.

Questionnaire

The FILTER questionnaire examines academics' current use of images, such as what type of images are commonly used, which are found to be most effective and why and what, if any, obstacles prevent or discourage image use. The questionnaire was made available online but was also distributed by email and post. Using this method, the FILTER team is able to gather rich data about a range of image users from different subject areas, and with differing levels of technical skills. Questionnaire responses, following analysis, will be taken to the practitioners' focus group for general discussion. Analysis will focus on examining relationships between disciplines and image types used, and between image types and perceived effectiveness of teaching. Also important will be an identification of common factors that inhibit uptake of particular image types.

A high percentage of questionnaire respondents have expressed interest in becoming involved with the project and are participating in either focus groups, workshops, interviews, case studies or usability testing.

Case Studies

Case studies will have two formats. The first series of case studies will follow the development and creation of the subject-specific image datasets by the LTSN subject centres. In most cases these are being created by subject specialists who have been sub-contracted as authors by the LTSNs. The FILTER team will work closely with dataset authors at all stages of development. Of particular note will be the ease of access to suitable images, the planning and structuring of the resources and the process of dataset creation. It is important that these phases of development are closely monitored and documented, firstly so that formative evaluation can be fed iteratively back into the ongoing dataset development. Secondly, it is important for FILTER to gain insight into the conditions in which academics create learning and teaching resources and the issues that dictate choice of pedagogic style, materials, tools, and so on, so that the procedures can be analysed, tailored and refined for easy replication by other academics.

The second round of case studies will involve the participation of practitioners who have been identified from focus groups or the questionnaire, or have been recommended by the LTSNs. FILTER researchers will observe use of the resources as they are being developed - in the form of usability testing - and also after creation, in a number of ways. The resources will be tested from a practitioner's perspective for ease of use and comprehension and for ease of replication, but will also be tested in an educational setting for pedagogical effectiveness. For example, by comparing student test results when using image-based revision material with those when using text-based resources. Outcomes will again be fed formatively into the development of the datasets and the refinement of criteria and standards for the creation of the additional ten image datasets.

Emerging Research Factors

From preliminary research, key emergent factors in current educational image use appear to be:

- Insufficient time for locating suitable images
- Insufficient time to prepare images for teaching
- Lack of collections of free, copyright-free digital images for educational use
- Limited access to technical equipment in the workplace for both creating and displaying image-based resources
- Costs involved with producing image-based materials

- Limited access to digital images
- Lack of technical skills, and little time available to learn them
- Large sizes of image files leads to downloading, handling and storage problems
- Difficulty of sharing images in large teaching groups
- The effectiveness and 'impact' of an image
- Images facilitate different learning styles
- Importance of image use in teaching those with learning and physical disabilities
- Poor quality of some digital images

Research into these common factors will continue through the project using a variety of methods permitting FILTER to accumulate a substantial body of quantitative, qualitative and action-based research data. Data will be fed back formatively into the development of standards and criteria for the image dataset creation, as well as the development and use of the datasets themselves.

Image Mapping

The following example illustrates the different types of image, in this case of a house, which could exist. It shows the richness of the concept of an image and clearly demonstrates that each of the image types could be used to support the learning and teaching process in very different ways.

Central to the set is the digital image of a photograph of the house. Underlying this resource are other types of 'images' available as learning and teaching resources, for example:

- A rough sketch of the house, outlining broad features, size and style
- A table of data showing previous owners/occupations/dates of ownership
- Numerical data, e.g. a table or graph showing square metres of rooms
- Associated text – an image of a page of text showing the deeds of the house, the survey and so on
- A schematic representation, such as the architectural plans of the house, flow chart of construction (either vector or raster representation)
- A macroscopic perspective, showing the house in context in terms of the street, town, country, continent
- A microscopic perspective looking at increasingly finer details of the house, from structure, to room, to microscopic images of building materials such as concrete, wood, tiles or bricks
- A multi-spectral image such as an aerial/satellite image of the house taken in different spectral wavelengths
- A 3-dimensional model of the house
- A virtual reality version of the house, for example providing the opportunity to take a tour of the house or a reconstruction through time showing stages of construction.

These images could either be: on 'conventional' media (e.g. paper, or an overhead projector transparency); 'born digital' (e.g. through a 'paint' type programme); or made digital through digitisation (e.g. a photograph that has been scanned).

Subject-specific Image Datasets

An exemplar subject-specific image dataset is defined as:

- A set of images typically used in that subject discipline
- "How-to" guides and/or case studies of how the exemplar images can be used to enhance learning and teaching within that subject
- Metadata that will link together technical, pedagogical and subject-specific information in such a way as to support and enable use by learners and practitioners.

These subject-specific image datasets will include as many different types of image as is feasible. An academic could take this model and adapt it to her/his own subject-specific requirements. This image dataset will be used together with the case studies or "how-to" guides to illustrate the contexts in which it is most appropriate to use a particular image type.

Metadata is particularly important for images as without accurate description there can not be accurate retrieval (Rorvig, 1999). Visual material requires description of a greater depth than textual resources in order to gain an understanding of its complexity and the implicit multiple layers of meaning and content (Turner, 1999). Describing images is further complicated by the nature of the material: it exists in pictorial form rather than in verbal terms. An investigation of image metadata is being carried out on behalf of FILTER by the UK Office for Library Networking, UKOLN (Online), renowned experts in the area of metadata research. UKOLN will produce a report for FILTER including recommendations and templates for the application of metadata. These recommendations will form part of the underlying technical standards for the exemplar database creation.

Each dataset will include, associated with it, appropriate "how-to" guides and/or case studies. The "how-to" guides will provide practical and easy-to-use step-by-step guidance on using and integrating the image resources into learning and teaching materials. The guides will be themed and incorporate issues of pedagogical and technical relevance. They will be available in Web and print format to ensure maximum usage. The guides are likely to cover the following topics, although exact details will arise from the collection themselves:

- Ideas for using specific image types to engage students in debate
- Topics suitable for exam questions
- Themes and issues arising from the collection
- Encouragement for students to use the resource
- Using the resource to support student workshops or projects
- Using the images to support lecturing and presentations (PowerPoint, Web delivery, etc.)
- Using the images in paper-based documents
- Using the images to initiate online discussion
- Ideas for using the images in collaborative learning
- Enhancing student materials by incorporating the images into computer-based learning
- Technical use of the images, e.g. for use in content-based retrieval.

Conclusion

It is known that a high level of expertise in image use already exists in certain subject areas, but possibly using a limited range of image types. The FILTER project is enabling, by working closely with a variety of LTSN subject centres, a cross-fertilisation of this knowledge across subject disciplines, so that there are multiple learning opportunities. This approach permits the research team to explore the factors of image use that are common to certain subjects. Synthesis of this cross-domain knowledge sharing in the exemplar database will ensure maximum benefit to the widest possible potential user-base.

This initiative to investigate and understand the appropriate use of images within learning and teaching is both pertinent and timely. The creation and delivery of large digital image datasets via the Web presents opportunities for the Education community. To benefit from investment in such resources, there is a need to ensure that the community understands what image resources are available and how they are best incorporated with existing and any future learning materials.

It is also essential to understand the nature of the primary factors currently hindering the use of images within learning and teaching. Integration of digital resources with curricula should be driven by educational need rather than the availability of technology or the influence of institutional policies (Hagdrup, Edwards, Carter, Falshaw, Gray, & Sheldon, 1999), and that development should be user-driven. Through research and investigation into the diverse pedagogical aspects of image use, FILTER will achieve an understanding of how best images may be utilised across a wide range of disciplines. These findings and outcomes will be refined into a set of guidelines and standards that can be adopted across disciplines, facilitating easy use and exchange of image information. At completion of the project, FILTER will be ideally placed to identify areas of image use for further research and investigation.

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ONLINE LEARNING IN AN UNDERGRADUATE NURSING PROGRAM: THE PERCEPTIONS OF THE LEARNING TECHNOLOGY MENTORS

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Abstract

This paper will examine the perceptions of the learning technology mentors (LTMs) involved in the development and implementation of the RMIT Online Bachelor of Nursing program. This program was identified as a "strategic program" within RMIT Life Sciences for renewal as there were major changes occurring in the disciplinary knowledge, professional practice and in higher education. Universities worldwide are seeking to enhance their competitive advantage in a changing environment. This competitive advantage grows out of the value it creates for its learners, either in terms of low prices or unique benefits. The Learning Technology Mentor program that the LTMs undertook to assist academic nursing staff in the renewal of the Bachelor of Nursing program for online learning is described. How the renewal program was developed and implemented is examined, identifying problems encountered in the process. The educational outcomes that emerged from the students' formative evaluation of the online learning program were both positive and negative and were consistent with the literature. A major issue was the reluctance of the students to move from a traditional learning/teaching paradigm to web based course delivery

Keywords

online learning, undergraduate program, learning technology mentor program, nursing student, evaluation

Introduction

RMIT University is committed to be an Australian leader in the use of information and communications technology in the design and flexible delivery of innovative education, training and research programs. Developing quality online learning environments is a major focus of program and course renewal within RMIT University. The educational renewal for online learning is a strategic response to major changes occurring in disciplinary knowledge and professional practice, and in higher education. The Bachelor of Nursing program was designated as a "strategic program" within RMIT's Faculty of Life Sciences for online learning.

It was recognised that the introduction and increasing use of information technology has had, and is continuing to have, a profound impact on health care service delivery. Members of the nursing profession need, therefore, to be educationally prepared to use information technology effectively to enable them to practise nursing skilfully and safely across the continuum of care in the diverse locations in which health care services are provided. In the higher education sector, it is anticipated that the development of online learning will enhance the profile and marketability of the Bachelor of Nursing program and will be of particular benefit for rural students, offshore students, full fee paying students, alternative entry (Division 2 Nurses) and graduate nurses. RMIT Nursing conducts the Bachelor of Nursing program in the metropolitan (Melbourne) and rural areas (Hamilton and Sale) of Victoria. The development of online learning was also seen as a means to maximise students' choice of learning styles, location, time and place of learning.

This paper will examine the development and implementation of online learning for the Bachelor of Nursing program articulating the problems and challenges encountered in the renewal process, as perceived by the Learning Technology Mentors within RMIT Nursing. The program renewal began in 1999 and is ongoing. It will also examine the literature and provide a background to the establishment of the LTMs at RMIT University.

Literature Review

The introduction of online learning in higher education exemplifies the current paradigm shift that is occurring in higher education. Traditional classroom teaching methods are being replaced with the electronic classroom. With improvements in information technology there is a change from lecturer-centred to student-centred approaches in the mode of teaching. In this mode of teaching the teacher plays the role of facilitator, mentors and coaches rather than that of information broadcasters. Students are evaluated on their problem solving skills, rather than on how much material they could memorise and recall. Students also need to be more self-disciplined and have greater self-management. They must know what to learn, how to learn, and have the ability to evaluate their own learning. The challenge in this paradigm shift is to change the mindset of students to build up confidence, encourage reflection, while self-learning and developing their collaborative skills. Students need to view things differently critically and creatively (Pan, 1999).

Bates (2000) suggests that the multimedia technologies, including web-based learning, will influence the forms and nature of knowledge. He claims that learning in the twenty-first century will be increasingly integrated with work and everyday life. Learning will be required on demand and will be organised in such a way that it suits the lifestyle and needs of individuals. Learners in this type of environment will need to become more learner-focused; that is to challenge and question what they are being taught, draw on their own knowledge and experience, and be able to adapt what they learn to their own particular circumstances. Bates identifies three ways that multimedia technology affects both aspects of teaching and learning. These are:

> In how it presents information; in how students interact both with the medium and through the medium with the teacher and other learners; and in how knowledge is structured within multimedia (Bates, 2000, p .2).

Although these new technologies are fundamentally changing the nature of higher education Bates (2000) however cautions that we need to maintain a balance between face-to-face teaching and learning and technology-based teaching and learning. Many skills cannot or should not be taught solely through technology, although most teachers probably underestimate the range of knowledge of skills that can be taught effectively in such ways.

The literature revealed more reporting of information regarding positive and negative experience of web based educational delivery rather than systematic evaluation plans. According to Ryan, Hodson-Carlton and Nagia (1999) evaluations of online courses in the past decade have been varied in the types of software, hardware, and connectivity. However some similarities in student and faculty perceptions of positive and negative attributes of online courses have emerged. Students from a variety of disciplines, including nursing, appreciate the time flexibility, convenience, and lack of travel concerns of the electronically delivered course (Guernsey, 1998a, 1998b; Hiltz, 1986; Phillips & Santoro, 1989). Increased proficiency with computers is also viewed as a positive attribute as well as the electronic communication such as asynchronous discussions and the networking with colleagues (Conry, 1998; Cragg, 1994a, 1994b; Landis & Wainwright, 1996).

The negative experiences cited in the literature include hardware and software problems. These are frequent sources of high frustration for students and lecturers. The cost and need for technical support to connect students electronically and the training of the students and teachers is a concern (Phillips & Santoro, 1989; Young, 1997). Other negative aspects of pedagogical issues include instructor time commitment to design, support, maintenance, and monitoring of electronic communications (Guernsey, 1998b; Phillips & Santoro, 1989; Smith, 1994; Young, 1997).

The literature also identified some research studies that compared the effectiveness of online delivery to traditional onsite classroom delivery of education. Phillips and Santoro (1989) evaluated a group discussion course to a computer-mediated communication course. The results from more than 500 undergraduate students showed that the computer-mediated method produced more frequent student contact with teachers. There was also a high level of course approval by students and group discussion outcomes equalled or excelled those of the courses taught in the traditional manner. The logistic and pedagogical problems identified with the computer-mediated communication course included hardware, software, and connectivity problems. Teacher workload time in maintaining asynchronous communication with students was also a significant finding.

Another study conducted by Ryan, Hodson-Carlton and Nagia (1999) evaluated undergraduate nursing students perceptions of classroom and web-based teaching. They surveyed 96 student nurses and the questionnaire was designed to evaluate students' perceptions of the experience in the classroom and their participation in the course via web based modules. They found that classroom methods rated significantly higher in relation to content, interaction, participation, faculty preparation, and communication. Technical skills rated higher for web based modules. Critical thinking and time allotted for assignments were not significantly different between classroom and web based modules. There were many open-ended comments and supported both negative and positive aspects of classroom and web based modules. These researchers claim that web based learning is the new paradigm in higher education delivery. The benefits, such as increased access, resources, and opportunities for diversity, far outweigh the problems and will take the nursing profession into the next century.

Renee Leasure, Davis and Thievon (2000) compared student outcomes taught in an undergraduate research course using both web based distance learning technology and traditional pedagogy. The students were given a choice of delivery and the reasons cited for selecting the web group section included cost, convenience and flexibility. Reasons for enrolling in the traditional classroom section included the perception of increased opportunity for interaction, decreased opportunity to procrastinate, immediate feedback, and more meaningful learning activities. The findings showed that there was no significant difference in examination scores between the two groups on three multiple-choice examinations or for the course grades. It was reported that students who were self directed and had the ability to maintain their own pace and avoid procrastination were most suited to web based courses. The other benefits of the web based course were the new methods of communication that were traditionally nurtured in the classroom setting and the teaching of computer skills that enhanced their confidence with the computer. What they also found was that student's writing skills improved over time.

What the literature shows is that web based courses are here to stay and can no longer be viewed by universities as an innovation. The challenge, like Bates (2000) says, is to determine what needs to be taught by this medium yet keep a balance between face-to-face teaching and learning and technology-based teaching and learning.

Background

The RMIT Teaching and Learning Strategy aims to provide a student-centred learning environment and one way to achieve this is to develop flexible learning modes using a range of educational technologies which expand students' learning opportunities and encourage staff to become facilitators of learning. The university provided money from the University Strategic Investment Fund for curriculum and courseware development, and for staff development. The need to harness information technology was recognised as a means of achieving student-centred, flexible learning environments. The Bachelor of Nursing program was identified by the Faculty of Life Sciences as a "strategic program" and this was to be developed "at a distance mode" for online learning. The RMIT Teaching and Learning strategy describes two modes of online learning (RMIT, Framework for Learning. Online)

One of the initiatives undertaken by RMIT Learning Technology Services to achieve the objective of the Teaching and Learning Strategy related to online learning was to appoint Learning Technology Mentors in each department. Learning Technology Services (LTS) was established early in 2000 to progress the Information Technology Alignment Project (ITAP) objectives that are a key component of the Teaching and Learning Strategy. The ITAP objectives focuses:

> On the use of information technology in learning by identifying that information technology will be used to enrich the learning environment by augmenting traditional methods rather than displacing them. The emphasis is on interactivity and time/space independence and flexibility (McNaught, Kenny, Kennedy & Lord, 1999; p. 4).

The Learning Technology Mentor (LTM) program at RMIT University provided for academic staff to have one day per week time release over one semester, in order to:

- learn how to use the university's recently established online education system,
- design and implement online learning in the Faculty's education programs, and
- promote and support similar activities among colleagues in the Faculty.

The LTM program ran from mid-1999 to the early part of 2001, and was jointly supported by the University's Learning Technology Services and the university's seven Faculties. The drive to online learning was central to a university-wide teaching and learning initiative to improve the quality of programs by renewing their educational design and adding greater flexibility to modes of studying them. We, the LTMs in the Department of Nursing and Midwiferey, undertook the program in 1999, 2000. The formal program was about a week long, in both three-day workshops and in shorter sessions. At the end of the formal session we had to produce a work contract that was to be signed off by the Head of Department, the Dean of the Faculty and the Director of ITAP. Funding was provided to the department for time release if we had successfully completed the requirements of the contract. In developing the contracts we were advised to negotiate and be supported by the Faculty Director of Teaching Quality, the Director of Information Technology, Learning Technology Services Professional Development Team, and ITAP.

In all activities we had to provide evaluation strategies and performance targets. We both decided to work together within the department to achieve the objectives of the LTM contract. For one of us this was the second year as a LTM within the department. Another requirement of the contract was a written report that highlights significant outcomes and issues for students, staff, and infrastructure services and for the mentors themselves. These reports provided information for the program teams, the Faculty and Learning Technology Services to inform continuing course and program renewal for online learning in 2001 and beyond. They also provided the opportunity for us to reflect on our work during the Semester and in previous Semesters. The funding for our time release was subject to satisfactory reporting on our LTM activities in the five major program outcome areas – content development; student learning experiences; staff interest in learning technologies; personal professional outcomes; system and program performance. Both our reports were satisfactory and our department received the funding for our time release.

Developing the RMIT Online Bachelor of Nursing Program

In developing the RMIT Online Bachelor of Nursing program we worked closely with the Faculty Director of Information Technology and Director of Teaching Quality to ensure that we were meeting the targets of the Faculty Program Renewal Schedule. The *first phase* of the renewal was to have a component of all the core courses (subjects) offered in Semester 1, 2001 to be online by December 16th 2000. The *second phase* was to develop all the 2nd Semester core subjects plus the electives offered by June 1st 2001.

All nursing academic staff were informed by the Head of Department that they would be required to develop a component of their course for online learning and staff developments activities were established as it was acknowledged by RMIT University that most would not be skilled in this area. We were seen as an integral part of the staff development activities and were responsible for organising the activities at a group and an individual level. We organised two planning days for the Bachelor of Nursing program team to examine how they were going to develop the online component for their courses. These planning days were conducted off campus and attendance was compulsory. It was imperative that all academic staff members were informed and encouraged to use online learning approaches. While some staff were comfortable with using computer based instructional materials many were not and this was mainly due to inappropriate computer equipment and the reluctance to embrace the new learning technologies. Supplying appropriate computer equipment became a priority within the department and this was achieved half way through Semester 1, 2001.

We also worked closely with the Learning Technology Services in directing staff to professional development sessions offered by them. The professional development program offered by the Learning Technology Services is twofold. Firstly, it provides training in the Distributed Learning System (DLS) tools, and secondly it offers a professional development program to assist staff in designing online courses. The DLS was designed to be flexible, pedagogically sound and user friendly that is the academics using it did not have to be technological geniuses (McNaught et al., 1999).The training sessions for the DLS system provided a basic introduction to the four tools used. These are: Course Information (classroom), WebBoard (conference), QM Perception, and WebLearn (critique).

The Learning Technology Services Professional Development Team first offered these sessions to academic staff in Semester 1, 1999. These sessions are conducted on a regular basis and are repeated throughout the academic year. Many of the nursing academic staff has attended all of these sessions. For those staff that could not attend the DLS training sessions, the Professional Development Team provided customised workshops. We worked closely with this team to ensure that the workshops integrated the tools with the educational design strategies adopted for the Bachelor of Nursing program.

We also encouraged staff to attend the series of workshops offered by the Professional Development Team in designing online courses using the DLS. Listed below are examples of topics that were offered and like the training sessions on the DLS tools, they were offered throughout the academic year.

- Assessment strategies for online courses
- Copyright issues for online course development
- Education design for content development
- Educational design strategies for online communication
- Evaluation strategies for online courses
- Library resources to support online course development
- Project planning for developing online courses
- Publishing standards for online course development
- Quality approval processes for online courses
- RMIT overview - policies and processes.

Information on production and resource developments was also provided in the Staff Lounge that can be accessed by all RMIT staff from the Learning Hub (Online@RMIT). Nursing staff were also directed to this resource. Although many nursing academic staff attended these sessions we also needed to conduct them within the department to provide more opportunities for staff attendance. Most of the staff took advantage of the sessions offered within the department and the wider university. There were some staff that were having difficulties in adapting to the new technology and we felt powerless to change this. For whatever reason they were not willing to cooperate and we had done all we could to encourage and motivate them.

The Learning Technology Services Professional Development Team also offered throughout the academic year a wide variety of seminars with guest speakers from within RMIT as well as externally. Many nursing staff attended these sessions and they helped in the development of their courses. We were also available to staff for specific assistance in the development of their courses and staff could negotiate with the Head of Department variation to their workload to allow them to focus on the course developments. Many did this so they could meet the deadline for the implementation for the 1st phase of the Bachelor of Nursing program renewal.

Implementing the Online Bachelor of Nursing Program

Phase 1 of the Bachelor of Nursing program

Phase 1 was to have all core courses completed and available in a flexible delivery format, including online learning, by Semester 1, 2001. This objective was achieved and all core courses and one elective for the Bachelor of Nursing program did have an online presence for Semester 1, 2000.

It was recognised that students would need some orientation on how to access and use the online learning activities provided in the core courses. The Bachelor of Nursing program is conducted over three years and there are core courses in each year. Two of the core courses (Year 1) had been offered in a flexible online mode since 1999 so some students were familiar with online learning, but not all. We negotiated with the Director of Information Technology within the faculty to provide sessions to students during the orientation week. This occurred however it was in a lecture format and the students did not have access to a computer. Due to the large numbers in nursing, approximately 250 students in each year, including the Hamilton and Sale Campus, it was impossible to give them all computer access. We did manage to orientate the Hamilton and Sale students using computers, as there numbers were manageable. The large number of nursing students is an issue, not only for orientation but also for the course coordinators especially in the area of communication with students. Answering emails and generating discussion and keeping it going is virtually impossible when dealing with 300 students.

The principal tool used by the course coordinators is the Classroom in the learning hub with some use of QM perception for assessment purposes. Some staff also used Netscape composer to create pages and used HTML tags in the classroom areas to enhance the presentation. This was particularly useful with the links to full text proquest journal articles.

Some delays were also experienced due to academic staff not being able to install QM perception on new computers. This is a result of inadequate consultation by the faculty IT support personnel and the network administrator. The network is also slow at times which delays progress.

Formative Evaluation of Phase 1

To determine how students were managing the online learning activities we distributed a questionnaire four weeks into the semester. The questionnaire was distributed to Year 2 students as all their courses in Semester 1 had an online presence. The questionnaire was designed to look at computer access as well as online delivery of courses. We received back 119 completed questionnaires and the feedback was valuable as it influenced phase 2 of the development process.

With regard to the online delivery of the courses, students were asked two questions related to each course. These were: What do you like about the delivery of the course? and What don't you like about the delivery of the course? The questions were open ended, as we wanted students to express what they really felt about the online learning. The responses were varied and the issues from the data are summarised below.

Preparation of Students for Online Learning

One of the major problems identified from the data was the preparation of students for this mode of learning. This is reflected in the following responses:

- "I believe that we should have been told last year about the online learning. We should have been able to have an impact on the idea. It is far too expensive for the fees when we are never here. I'm just really annoyed about the whole thing and believe that we as students should have been able to decide whether we wanted online learning or not as it is our education."

- "I think the online component was too much, too fast. The first term would have been an easier transition if more time were spent in tutorials to actually discuss the topic matter as well as solving any online access issues. I think lots of people were anxious in being able to access all the information available."
- "I think it is a lot more difficult to do things this way (i.e. over the internet). Firstly it is more time-consuming, a lot more confusing and inconvenient for many people if they don't have the Internet or few computer skills!!!! It would be helpful to have lecturers who know how to explain how to use the learning hub or a course to teach us."
- "I think we should have been told last year about the online learning. Why pay $4000 approximately for learning off a computer when you also have to pay $337 to attend uni and then $? Access the internet from home."

This feedback indicates that students needed more preparation for online learning and the option to choose traditional pedagogy. We are addressing this for Semester 2. There were also some program management issues that also contributed to this problem. The literature shows that students web-based courses require a certain level of computer literacy if they choose this mode of educational delivery and they need to be well prepared or trained in this area.

Educational Outcomes

The educational outcomes for the students were both positive and negative. The positive responses related to the content provided, the self-directed learning and being able to work from home and these are reflected in the following responses:

- "I feel that having an online component is a great idea. Accessing and being involved in discussions and finding info at your own leisure at any time of the day is quite convenient. It also motivates me to do work!!!!"
- "Can access at own pace, can link to journals, easy to negotiate around site."
- "The huge amounts of resources that are available like articles and links."
- "Less travelling and easier to study at home."
- "Easier to access information in relation to subjects whenever we want or when hub is available."
- "Access to work/notes to prepare for tutorials and get ahead if you want to, flexible-able to work when it suits, weekly exams are good."
- "You are able to access at anytime, which fits in well when you are working, etc. It allows you to study at any time you like and allows me to work due less contact hours."
- "I like that you can work at your own pace and its is a different way of learning."
- "Freedom. No crowded lectures with loud students. Autonomy and responsibility."
- "Overnight availability is user-friendly for night-shift workers such as me."
- "There are very clear course documents and outlines."
- "I prefer to do the tests each week instead of a big mid year exam."
- "Discussion board and online test (weekly)."
- "No long lectures that bore you to death."

We can see from the above responses that many of the students enjoyed the online activities. These positive experiences are consistent with the literature. Whether these students have had significant learning gains is too early to ascertain however feedback from the clinical area, where these students integrate the theory component of the courses, indicate that the knowledge level was impressive and much better than last year. In one course, Medical Nursing, students commented on how they had covered all the diseases they encountered in the clinical area in the online learning. They commented on how well prepared they were when caring for patients with these disorders.

The negative responses mostly related to the lack of class time, lack of orientation to online learning, cost of education and home internet, too much information, and the fact that they were "nurses" not "computer whizzes". The lack of class time was a problem for many of the students and this could have been avoided if there was more communication within the program team. There was lack of planning on how all course coordinators were going to deliver their online component to the course. This resulted in lack of class time and the only student contact was hourly tutorials and some planned nursing laboratory sessions. This did not mean less time for the lecturers as conducting tutorials for groups of 20 to 30 requires more contact time. Some of the students' responses are listed below:

- "The amount of contact hours per week. I would prefer to have more compulsory labs and classes per week."
- "Lack of interaction (physical) with other students and lecturers."
- "Not enough hands on! 1 hour tute not long enough to reinforce learning."
- "Its not so much the online sites but the lack of contact hours that I don't like."
- "Nearly everything!!!! Harder to be motivated to learn in front of a computer rather in a class full of people where you can discuss/ask questions etc. It is also inconvenient for some people don't have Internet or computers at home."
- "Lectures are needed. It is a must, OK, I'm thinking of transferring to La Trobe, they seem to be offering more for our money."
- "I just feel that nursing isn't what it should be, nursing is a hands on profession and we aren't getting any of that."
- "What are we paying fees for? Where does the money go?"

The limited face-to-face class time has been addressed for Semester 2 and there will be more face-to-face teaching. One of the issues relating to this is the number of student nurses doing the online course. There can be over 300 enrolled in a course and there may be only two academic staff teaching in this course. The feedback from students indicates that they want the traditional methods of teaching combined with the online learning. This raises the issues of staff workload. Many of the staff within the department have had their workloads increased since the introduction of online learning. For online learning to be effective this issue has to be addressed within the department, the faculty and the wider university. Additional staff are needed to assist with tutorials, laboratory sessions and the management of online communication such as the threaded discussion boards and the email. There are some courses within the Bachelor of Nursing program that do not require extensive laboratory sessions and would not require as much assistance yet two nursing staff would still be responsible for approximately 200 students, far too many for some aspects of online learning.

Another reason for the limited face-to-face class time related to the nursing staff's perception of what was required to be put online. We questioned the RMIT Teaching and Learning strategy interpretation of "at a distance mode" of online learning and what was meant by "substantially" online. There was never a definitive answer or explanation. Many nursing staff put most of the course online and the only traditional teaching method required was a tutorial that meant reduced traditional face-to-face contact hours. This issue has to be dealt with if the online learning is to be successful within the department.

Student Computer Access

The feedback from students regarding access to the online learning materials was varied. Some of the students had no difficulty whereas others did and found the experience very frustrating and negative. This is reflected in the following student comments.

- "Sometimes I cannot log into the computers. The account name and password cannot recognise even though they are correct."
- "I have a big problem to get access to the DLS from home."
- "At home whenever I log on to student Email I get logged out after about 20 seconds and this happens again and again."
- "Sometimes you can't access email services, it cuts you off, and you have to log in again and again."
- "Don't have the Internet at home, couldn't access the Hub using my ID number."
- "I tried to get the Internet through the email-student discount. This was a complete waste of time! I was eventually told through oz mail that RMIT had failed to give them some information they were waiting on, ended up going through someone else. This wasted 2 weeks."

While students had access to computers facilities on campus they had to share these resources with students from other disciplines. Those who did not have access at home felt disadvantaged in completing the online learning activities. Many of the problems related to student's access could have been avoided if they were better prepared. A lot of the problems were associated with user error. The need for hands on training in using the computer cannot be overstated, even for students who rate themselves as computer literate. Technical difficulties such as suitable computer access and network reliability created significant problems for some students. The student email system provided to all students at RMIT would time out within seconds of access for many students. While this was identified as a problem it was not resolved and continues to frustrate students. These issues need to be solved if online learning is to be successful at RMIT. These findings were consistent with the literature as most of the problems identified related to hardware, software and connectivity.

Phase 2 of the Online Bachelor of Nursing Program

The second phase was to develop all the Semester 2 core subjects plus all the electives by June 1st 2001. In March 2001 a Project Manager from outside was employed to assist with the program renewal of the Bachelor of Nursing Program. It was seen that this person would be more effective in facilitating the process of getting the courses and electives online. As mentioned earlier there was some nursing staff reluctant to embrace the new learning technologies. An outside Project Manager would perhaps provide more motivation for these staff members. The LTM program is not currently being conducted by RMIT Learning Technology Services, as there are now sufficient LTMs within the university who have been trained in developing online teaching and learning activities for the colleagues within their departments. The second phase is ongoing, all the core and elective courses have an online presence and they will be online for students in Semester 2.

Reflections

On reflection one of the major challenges to come out of our experience is that people cannot get away from the traditional paradigm of teaching that requires students to sit and listen to a lecture to learn. This view of teaching and learning is not only limited to students but also to many of our colleagues. We need to maintain a balance between face-to-face teaching and learning in nursing and understand what should be technology-based and what should be taught in the traditional classroom or laboratory setting. We also need to embrace the changing role of both learners and teachers, in order to exploit the benefits of online learning.

Despite these rather negative comments the opportunity to undertake the role of LTMs has enhanced our knowledge and confidence in developing online teaching and learning activities. There is enormous potential to develop these strategies further with industry as it has the potential to lessen the gap between nursing theory and practice in the real world of health care delivery.

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STUDENTS AS INFORMANTS FOR WEB-BASED LEARNING DESIGN

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Abstract

This paper presents the general conclusions of two research studies into the attitudes to Web-based language learning of primary, secondary and tertiary students around the globe. Factors investigated were student comfort, enjoyment, learning styles and strategies, study preferences, and age and gender differences, as well as the students' assessment of how useful the experience was. One clear result is not only that students are not hostile to Web-based learning, but that the Web provides a viable medium for teaching. Recommendations are made about pedagogical and technical requirements for effective Web-based language teaching.

Keywords

web-based learning, evaluation, design, learning strategies, learning styles

Description of Studies

Two surveys of students' attitudes and experiences asked whether the Web is a viable medium for language learning, either as an add-on to classroom teaching or as distance education, which elements help make Web-based learning effective, and what the technical and pedagogical requirements of good design are. The 208 participants - 136 female and 72 male ranging in age from 10 to 75 - comprised 22 primary, 82 secondary, and 104 tertiary or adult students of English as a Second Language (ESL), French, German, Italian, Japanese and Spanish, enrolled in 2 primary and 4 secondary schools in Australia, 5 tertiary institutions in Australia, Israel and the United Arab Emirates, and 1 on-line course. 111 were native English speakers and 97 claimed another native language. All courses used the Web as an addition to face-to-face teaching, with the exception of Cyberitalian (Online) which teaches a structured course entirely online.

Questionnaires focussing on learning styles (Reid, 1998), strategy preferences (Oxford, 1990), levels of comfort and enjoyment, perceived advantages and disadvantages of the Web, and overall judgements of the quality and usefulness of the materials were administered at the beginning, middle and end of three months' exposure, and a small random sample of students were interviewed at the end. 164 valid responses were received for the first two questionnaires and 128 for the third. Univariate analyses of variance were used to identify significant relationships between selected variables. Detailed analyses for each study can be found in Felix (2000) and Felix (2001).

Discussion of Results

The strong general conclusion to be drawn from both the quantitative and qualitative investigations is that the Web is a viable medium for language learning. Reported advantages (133) outnumbered disadvantages (90), with the main advantages time flexibility (33), wealth of information (30), fun (13), reinforcement of learning (10), variety (10), privacy (8), gaining computer literacy (8), the absence of a teacher (6), the ability to repeat exercises (5), and learning culture with authentic materials (5). The interesting new advantages here are *wealth of information* and *absence of a teacher.*

Reported disadvantages were the lack of speaking practice (20), unreliability and slowness (17), the absence of a teacher (15), distraction (14), absence of interaction with peers (13), and inadequate feedback (11). Here, the advantage of *wealth of information* seems to have created a new disadvantage of *distraction*. The other disadvantages — *lack of speaking practice, absence of teacher, no interaction with peers* and *inadequate feedback* — have been common in technology-based language learning, but it is encouraging that the new technologies allow them to be addressed more easily.

Comfort, Enjoyment and Usefulness of Materials

Learners of all ages felt comfortable and enjoyed the environment. When this was not originally the case, comfort and enjoyment grew over time. Not surprisingly, beginners were least comfortable and distance students and younger students most comfortable. Since the distance students had chosen this mode of study, they might be expected to perceive it more favourably, but their feeling of comfort is still a strong indication that there is a future for the Web in distance education. A clear majority of students – most particularly younger students - found the Web useful. An important finding was that they found materials most useful if they felt comfortable and enjoyed the experience.

Impediments to Web-based Learning

Our studies confirm strongly that the biggest hindrance to learning is malfunctioning technology. This has been reported throughout the CAL research, and the Web is no different (FuturEd, 2000; Schifter 2000; Hara & Kling 1999; Owston 1997), with server capacity and bandwidth posing new problems. A strong recommendation, therefore, is to test Web resources fully and to train students in their use before they are integrated into the curriculum.

Mode of Delivery

The preferred way of using the Web was within face-to-face class teaching. The least preferred was distance education without a tutor. These results may be another example of students opting for the familiar (Felix, 2000), so we cannot make clear recommendations about the single best option for delivering online materials. What we can say is that students are receptive to a variety of modes as long as they have access to a teacher either face-to-face or by email. Male and non-native students were most dependent on face-to-face contact, a fact that lends support to anecdotal evidence that these groups are less confident language learners and need the extra help provided by a teacher (for boys finding heavily language-based learning uncongenial see Prior, Sanson, Smart & Oberklaid, 2000). It would therefore be sensible to give special consideration to their needs when designing materials. The fact that time flexibility was the most frequently identified advantage in the qualitative data suggests that students are prepared to use materials in their own time. This is another reason to think that distance learning is viable, whatever the challenge of providing meaningful feedback structures, support mechanisms and communication facilities.

Study Preferences, Learning Strategies and Learning Styles

Study preferences were evenly divided between working alone (31.1%), with a partner (33.5%), or in a group (35.4%) - data that argues strongly against a uniform teaching approach. No significant relationships were found between study preferences and any of the variables under investigation - somewhat surprisingly, perhaps, since we might have expected a preference for working alone to emerge as a special strength in Web-based learning. Similarly, no significant relationships were found between learning strategies and perceptions of various aspects of the environment. Learning styles were distributed less evenly across the categories, but again no significant relationship with other variables was established. However, a strong preference was expressed for *kinaesthetic* and *tactile* as a major learning style and for *visual* and *auditory* as a minor style - a preference that appears to be conducive to working with the Web.

One finding emerged strongly: we are dealing with very heterogeneous groups, which display great variety in study preferences, learning strategies and learning styles. However, the new technologies have the exciting potential to deal with heterogeneity, and to give us the means to produce applications, resources and activities that can address differences in strategies and styles, and cater for a broad range of student needs (see Felix, 2001 for different approaches).

Design Implications: Technical and Pedagogical

The factors that adult students valued most highly in terms of the usefulness of the materials were *clear objectives, ease of navigation, meaningful feedback*, and *clear and logical content.* Data relating to younger students were not reliable enough to allow definite conclusions to be drawn, but these factors are clearly linked to good teaching practice and should be taken into account in designing resources.

Feedback

The importance of feedback emerged strongly from both quantitative and qualitative studies and was expressed by students of all ages. This finding is supported by the current literature (Lyall & McNamara, 2000; Sims, 1999) as well as by earlier studies on distance education (Haughey, 1990), and is strongly emphasised in papers on quality indicators (FuturEd, 2000; Illinois Report, 1999; Kearsley, 1998; Ragan 1998). Given these findings, more needs to be done to ensure excellent feedback. A minimum adopted by many sites is to present the question, the student's response and the required answer, perhaps with green ticks and red crosses, and a running score. Beyond this, best practice would provide hints to help students who have difficulty with the questions (students dislike simply being referred to a textbook), along with meaningful and relevant comments on any errors, so that the whole process goes beyond simple marking to the stimulation of learning.

Sound

Where listening is concerned, the fact that the school-aged students complained about the lack of sound or its poor quality may have reflected deficiencies in their IT environment. Certainly, the Web already provides many excellent examples of activities delivered at high quality, with streamed audio the minimum standard we should accept for the delivery of quality sound (Goodwin-Jones, 2000).

It was not surprising that the lack of speaking practice was seen as a great disadvantage, even if comments may have reflected assumptions about what distance learning can provide. As some teachers have reported, there is no reason why students should not talk to each other in the target language while using Web materials. Apart from such in-class activity, the Web offers as many speaking opportunities as the previous generation of CAL, with voice recognition and recording already being integrated by sites such as Global English (Online). One may, however, be sceptical about the general usefulness of such resource-heavy devices (Felix, 1997). Why not reserve oral practice for the classroom and exploit the unique potential of the Web which lies, in the students' own words, in its provision of instant authenticity, wealth of information and reinforcement of learning? Other considerations apply to distance education where it is critical to integrate speaking practice. Some providers are adding sophisticated tools such as Web phone, audio, and video conferencing, and sites such as Wimba (Online) are showing what can be done with asynchronous technologies such as streaming voice email and voice forums in the form of a threaded message board with spoken messages.

Graphics

In line with Owston (1997), younger students were most impressed with graphics, but, surprisingly, a high rating for graphics did not mean that materials were perceived as more useful. There was, however, a strong indication that students spent more time working on the Web if they valued the graphics highly, so strategic integration of graphics may be worthwhile. It is worth emphasising that students were exposed to fairly simple and sparingly used graphics. Of course, professionally produced graphics will always be preferred, but the resource implications are huge. If little homemade stick figures can have a positive effect on student motivation to work longer, why not start simply?

Conclusions

The results are positive for the incorporation of the Web into language learning, with no indication that technology is a threat to the survival of teachers. It is difficult to imagine that the Web will ever replace best-practice face-to-face teaching, and more and more practitioners and constructive critics are coming around to the view that the greatest potential for the Web is to add quality to teaching and learning environments (White, 2000; Feenberg, 1999; Owston, 1997). This is not to suggest that the Web does not also offer potential for quality distance learning, but the challenges here are greater. In either case, a basic requirement is that environments be stable and objectives clear. A positive aspect is that, in well-planned conditions, students not only find the Web enjoyable and useful, but are also prepared to work longer hours. If this finding holds over time, there must be a real prospect that the use of the technology will lead to an improvement in learning outcomes.

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BACKYARD WISDOM AND STUDENT INSIGHTS IN DEVELOPING EFFECTIVE WEB-SUPPORTED LEARNING

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Abstract

A critically reflective account by two teachers seeking evidence of learning and the influence of technology in a web-supported approach, this paper examines rationale, student feedback and outcomes. A case is also sought for employing a cohort-specific approach to web-supported learning through pre-surveying students to reveal their access levels and affective responses to the technology in order to inform the pedagogic framework. With other 'backyard' practitioners in mind, the paper concludes by reinforcing the value of sharing the wisdom developed through such localised, idiosyncratic applications of the web in teaching and learning.

Keywords

web-supported learning, student feedback, cohort-specific, affective responses

Introduction

Parallel to the expansion of an institution-wide online teaching system, it has been observed in the Faculty of Built Environment and Engineering at Queensland University of Technology (QUT) that many localised, individual approaches to web-supported teaching and learning remain and are even flourishing in some cases. Such cases are characteristically developed and managed by a single academic, utilising both rudimentary and increasingly sophisticated web applications. Some academics have been developing their approaches over several years, responding to formal and informal student feedback and the introduction of new applications and hardware capabilities. There is a belief held that significant 'backyard wisdom' is embodied in these solitary and idiosyncratic uses of the web to support learning, from which other practitioners might benefit.

The focus shifts then to one such backyard practitioner who has developed her own web-supported approaches with first year on campus architecture, interior design, and industrial design students. Armed with the conviction to gather evidence of student learning resulting from the web-supported approach and to re-examine the pedagogic rationale for integrating the technology, this paper is a collegial attempt to critically reflect upon a semester's action in order to more rigorously develop subsequent approaches. This motivation rests on an understanding that effective student learning with technology is influenced by a complex interplay of both contextual and technology factors (Gunn, 1999).

This localised study uses key issues and findings from an earlier study by the first author in the same setting to prompt critical reflection in our scrutiny of the current web-supported approach. The objectives are to:

- identify evidence of learning tied to the web-supported approach;

- re-examine the rationale for the approach and its targeted learning;
- establish if a case exists for a cohort-specific approach as advocated in the original study; and
- share the outcomes with other 'backyarders'.

Background

The original study and inspiration for this critical reflection, was conducted with first year interior design students in 1999. It followed the technological literacy work of Rossiter and Bagdon (1999) at QUT and drew on the student experience focus of Gilbert (1999). The survey sought to establish levels of students' computer access and technological literacy, preferred communication modes, and their affective responses to the role and use of computers and the web in their studies. The student survey component was designed to be used with students *before* the integration of web-supported learning; the intention being that any such implementation would be more grounded and responsive as a result of a thorough understanding of the cohort in the disciplinary context.

The major findings of the study were:

- Students possessed high levels of access to computers and the internet, but did not tend to utilise either uniformly;
- Face to face communication was the preferred mode with teaching staff closely followed by email, with similar being true of peer interaction;
- In using computers to assist their studies, students tended to have a utilitarian value for their ability to assist project preparation and presentation;
- Students held highly divergent views upon the role of the web and its value, while admission of poor search skills was quite common; and
- There was a common view of information or access to resources equating with learning, signalling the issue of critical literacy development.

The survey instrument was used again with first year interior design students in 2000 from which highly contrasting results emerged in all respects, with these students clearly living lives more socially mediated by information and communication technologies. This supported the original belief that each cohort had to be considered as both inherently diverse and qualitatively unique *prior to* the planning of web-supported approaches and their pedagogical frameworks. These year 2000 students formed a subset of Sheona's second semester cohort in her account below and I sought to discover her individual rationale for introducing web-supported approaches.

Sheona: Up until the year 2000, I had made no use of online tools to aid my teaching. At the beginning of first semester, I decided to build my own website to augment the limited personal face to face time I had with students in the first year architecture units I was teaching. The units were studio-based design and drawing units, with supporting lectures. Students spend several hours a week with their studio tutors in one-to-one critiques and project reviews, but very little with me - the coordinator of their project work, and the ultimate arbiter. I felt myself to be at a distance from the group, and was searching for a way to support the students in their work beyond the limited viewpoint of the traditional lecture. Designing requires students to view a problem from multiple and often divergent perspectives, and I felt that the medium of the web could be employed to intervene, somewhere between lectures and the dialogue that students were having with their tutors. My simple aim was to create a means for students to have 24 hour access to any information I wanted to broadcast, such as additional visual content, strategies for thinking through difficult issues raised in a lecture and tips and tricks for design project work. Conceived as a web-based 'study-guide-in-process' it would be highly responsive to the unit dynamics as the semester progressed. Using the web space allocated to staff on the school server, I taught myself web-authoring, and started to build.

My 'home-grown' endeavour achieved good things, in so far as it met the aims of augmentation and intervention. It was well received by the students. They regularly accessed and worked through the content. Evidence of this could be clearly seen in their process work, journals, and drawings. Our collective confidence with, and enthusiasm for, the medium took root. In the second semester, I had a unit in foundation design history to deliver to a large class of first year architecture, interior design and industrial design students. Buoyed by the first semester experience with the architecture students, I felt compelled to use online technology to support the teaching in the unit. This time however, I decided to take advantage of the centralized QUT OLT (OnLine Teaching) system. My thought was that the coordinated, controlled, restrained face of OLT would be a good foil to the first semester 'seat of the pants' approach, and more suited to dealing with a large group of students.

Methods and Musings

Realising our mutual interest in this student cohort after the fact, we were each keen to examine the other's experience of the pre-survey and then the semester as it actually unfolded. We worked through the survey themes seeking correlation and variance between the initial student views and those expressed later in the online feedback. The themes included access; technological and critical literacy; preferred communication modes; the role of resources; and affective responses to using computers and the web.

Sheona: In entering the tightly organised, database-driven world of QUT OLT, my strategy was to use the most engaging functions of the system and augment it with material on my own school-based website. I incorporated OLT-based functions I wouldn't otherwise have been able to set up with novice skills – in particular discussion forums, chat rooms, and quizzes. I set modest learning objectives to relate to these online functions (e.g. participate in discussions with others about the course content to advance your own learning; demonstrate ability to retrieve, evaluate and use relevant information to advance your own learning; be able to use current technologies to advance your own learning) and set 'online participation' as a course requirement that would see students lose 20% of their final mark if they had not made a minimum contribution by the close of the semester. I also took a big step to 'force' the uptake of online interactivity by not scheduling weekly tutorials for the unit. With tutorials out of the equation, the modes of delivery were lectures, video screenings and online support.

It should be noted that the foundation design history unit is fundamentally different from the first semester architecture studio units in which I had initiated a web-supported approach. Traditionally, foundation courses in design history are a race through time, with lots of designers' names, dates, buildings, sculptures, artefacts, 'isms' and movements to digest and remember. In face to face tutorials, the struggle for tutors is to get students to speak up and discuss this mostly overwhelming area of study. In shifting discussions online into asynchronous forums, I was uncertain if this pattern would be repeated, or if the web medium would offer a new style of liberation. The web-supported approach also facilitated the accommodation of various points of view on course topics and in drawing on the vast network of resources developed for similar courses around the world.

As it turned out, by far the most successful element of the web-supported approach was the asynchronous discussion forum. A fresh forum was created at the conclusion of each week's session of lectures and video. The modest minimum course requirement for participation (1 question, 2 responses) would have extrapolated into a total of approximately 450 student postings in all forums for the semester. The actual number of student postings was in the order of 1400. In addition, unit staff contributed approximately 160 postings. In noting the date and time of postings, it was shown that many students scrambled away from the lectures and into a lab to start the weekly discussion rolling.

Mostly the discussions were unregulated and spontaneously ignited by a student's wondering. Unit staff (myself and other contributing lecturers) regularly posted responses to student questions, and participated more generally in the discussions. Tangentially, the contributing lecturers noted that it was useful for them to participate in the forums as a means to gauge understanding of the content of their lectures. In the forums that I set up to answer a specific set of questions, in relation to a video or reading, participation was limited. As soon as a few students attempted the question, the discussion halted. In forums where outrageous discussions erupted (e.g. the role of alien life forms in the construction of the pyramids) the number of postings skyrocketed, as students either revelled in the silliness or tried to ground their peers in some sort of rational, objective understanding. This observation about the interest in structured versus spontaneous discussion forums accords with that of Gilbert (1999).

At the end of the semester students were invited to respond to a five question online survey (five-point likert scale with opportunity to submit extra comment). The survey sought specific feedback about content and delivery. Thirty-nine percent of students responded. Of these 85% agreed (35%) or strongly agreed (50%) that the online teaching component was useful to them and should be continued. One student responded that "as the class sizes are so large, the online forum (using asynchronous discussion and synchronous chat functions) provided an excellent means in which to *learn from one another* throughout the entire semester". Another, while strongly supporting the use of OLT in the unit, suggested that the web-based approach was more "advantageous" to students with good home access to the Internet, for whom participation *really was* flexible.

Delusions and Conclusions

In the 'always-on', networked world, it might be assumed that web-based approaches to teaching should succeed magnificently, with student feedback and evidence of learning supporting the notion on this occasion. We propose that for an academic considering web-supported learning, understanding your cohort is an important factor if only to tailor your method to include persuasion towards meaningful engagement with the approach. Even greater refinement is possible through application of different cognitive strategies and frameworks as detailed by Campbell (1999) which can more accurately target student demographics, learning styles and cultures. The web-based approach discussed here was founded on an ideal of responsiveness, reflection and faith with general assumptions being made about the student group prior to the commencement of the unit. On reflection, this assumption may well be better tempered with the findings of a cohort specific pre-survey in hand, particularly with regard to fundamental issues of access and computer skills. While most students engaged fully, we are sure that a few slipped through the cracks, making last minute postings to the forums and never really accessing other areas of the site.

But while a pre-survey has value, it is interesting to note how divergence from preference to experience may be modelled. The preference for face to face contact evinced in the pre-surveys of first year interior design students is interesting to note in light of the surprisingly enthusiastic use of the discussion forum in the history unit. One could miss an opportunity for exciting web-based engagement by following too closely the preferences of students. Equally, a student group could also be alienated through unresponsiveness to their particular collective dynamic. Through these experiments and explorations we begin to build wisdom, gradually advancing our understanding of the web-based approaches, in surprising directions, which is why a chat over the back fence is necessary at every opportunity.

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VIRTUAL VERSUS TRADITIONAL DISSECTIONS IN ENHANCING LEARNING: A STUDENT PERSPECTIVE

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Abstract

This paper describes a study comparing the perceived effectiveness of "real" and "virtual" dissections in a first-year human biology course. Data were collected from enrolled students using surveys and focus groups within an action-research methodology. The findings suggested that there is little difference between the two types of instruction in terms of learning the structure and function of organs. However, while the results showed that over 65% of students used the virtual materials, access to computers or the Internet was not a determining factor for those students who did not access the virtual dissections. These outcomes reinforce the need to offer a variety of learning experiences that target different styles of learning.

Keywords
dissection, real, virtual, effectiveness, comparison

Introduction

The use of dissections within biology courses, especially of mammals, is becoming more controversial, leading teachers and students to reconsider the value of these procedures in the classroom. Typical alternatives to using live animals for dissection are preserved specimens, 3D models, videotapes of experiments, self experimentation, videodiscs and computer simulations. Based on our experience over the past ten years, these options appear to fulfil the majority of objectives required for the student experience of dissection. It has also been shown that when students are offered an alternative to dissection using models and charts, there was no significant difference in their written examination results, in particular on those based on the dissection, compared to students who completed the dissection (Downie & Meadows, 1995). Their study also found that although the dissection was regarded as one of the most interesting practicals in the course, it also achieved the highest disapproval rating because it involved the taking of life. Similar studies support these findings (e.g. Kinzie, Strauss & Foss, 1993; Predavec, 2001).

Over the last ten years an increasing awareness of animal rights issues and ethnic/cultural sensitivities to whole animal and animal parts dissections has led to changes in the structure of our practical classes, with some dissections being replaced by computer-based material. Many of our students no longer need the hands-on experience of performing animal dissection, particularly as the emphasis is on understanding the functional anatomy of the animal rather than manual dissection skills. We also have logistical problems supplying cat cadavers to the 800 students in the cohort each year. Consequently we have developed several computer-based simulations which allow students to investigate mammalian structure and function as an alternative to animal experiments and dissections. The modules were introduced in 2000 and are available via our online virtual learning environment (Biological Sciences, Online) and on computers in the laboratory. They are accompanied by paper-based materials and are fully integrated into the curriculum. During the course students use a part-dissected cat cadaver to handle and explore its digestive system (learning by experience and discovery). Subsequently they use a virtual dissection to review their understanding of the digestive system (optional, used as a supplement or alternative to the actual dissection) and to investigate the cardio-vascular system (no real dissection available).

It was important for us to gain an understanding of the relative usefulness of animal and virtual dissections in terms of learning outcomes to help inform the debate on the replacement of animal cadavers in student laboratories. Given this environment, this paper examines the role of real and virtual dissections on the learning opportunities for a large group of first year students.

Methodology

This investigation of the use and usefulness of animal and virtual dissections for student learning was a component of a larger investigation examining all learning resources in the first year biology course. These included a range of computer-based learning modules, online materials and communications strategies in addition to the more traditional learning resources such as lectures and practical sessions (Franklin, Lewis & Peat, 2001). The participants for this study were 400 students chosen randomly from the cohort of 800 first year biology students. A combination of qualitative and quantitative survey questions as well as focus group discussions were used to collect data on the use of virtual dissections as a replacement for animal dissections. These data were collected in the week following the introduction of the computer-based simulation and at the conclusion of the course.

Results and Discussion

The results from the first data collection indicated that only 50% of the students had used the computer-based virtual dissection programs, and of those they were either used alone (78%), in the practical class (47%) or at home (53%). However, by the end of the course 68% of students had used the virtual computer-based dissection materials.

The results depicted in Table 1 show two important trends. First, of those students who used the virtual dissections, 66% perceived them to be either useful or essential for their learning and understanding of both the structure and functions of body systems. For those students who used the animal cadavers, 72% responded that the real dissections were either useful or essential for understanding structure whereas only 62% agreed with them being either useful or essential for understanding functions. This indicates that both forms of learning resource can play an important role in developing student understanding. Second, and more importantly, is the finding that between 28% (n=112) and 38% (n=152) of those students surveyed found either dissection method to be of little or no use. The implications for this in terms of provision of teaching resources to accommodate learning preferences is significant.

	Understanding structure (%)		**Understanding function (%)**	
	Real	**Virtual**	**Real**	**Virtual**
Of no use/some use	28	34	38	34
Useful/ Very useful/Essential	72	66	62	66

Table 1: Usefulness of real versus virtual dissections in understanding structure and function

The data in Table 2 indicate that the majority of students (71%) perceived the real dissection experience to be more useful than the virtual dissection experience (47%) in developing co-operative learning skills. However more students (64%) perceived the virtual experience as useful in developing an independent approach to learning than the real experience (51%). This difference is to be expected as students work in peer groups of 4-5 for the real dissection, whilst the majority of students (78%) reported using the virtual dissection materials alone.

	Developing co-operative learning experiences (%)		Developing an independent approach to learning (%)	
	Real	Virtual	Real	Virtual
Of no use/some use	29	53	49	36
Useful/ very useful/essential	71	47	51	64

Table 2: Usefulness of real versus virtual dissections in learning

Overall the data indicate that students find both real and virtual dissections useful for their studies. However, in this study a proportion of students found both methods of dissection "of no use" to their study, which reinforces the requirement for academic departments to continually review their resources to ensure they meet student needs. In addition, the data showing that selected students found the virtual dissections of no use suggests that the development of such resources, which are often costly, must be carefully justified and comprehensively integrated into the course of study. The reasons for these trends can better be understood by reviewing the responses to a variety of open-ended questions on the use of virtual versus real dissections, which were thematically analysed and categorised. There was an overwhelming response (68% of total) in favour of the hands-on nature of using dissections (even though the cats are pre-dissected and preserved), with a subsidiary comment about the availability of 3-dimensional material (11%).

> Can display live (sic) cat easily and can move organs around and can follow through the system better!
>
> Hands on learning is much better than 'virtual' learning.
>
> You could move the parts around and see them in 3-D.

Perceived advantages with the virtual material were identified by only 18% of the responses, the most frequent being on the clarity of information and ease of following it on the program (14%).

> On the VM (virtual material) more info is given which is great, however hands on experience with real cats is a great advantage!

One of the main messages was that many students (44%) perceived the real dissection to be better than the virtual as a learning resource, even though many commented on the unpleasant nature of the pre-dissected preserved material.

> With cat cadavers you can examine more closely the systems within the cat as you can move things around to get a better idea of where things are placed and can see where they are attached. The virtual dissection was probably a lot more detailed and informative, but the cadaver provided a better idea of where things fit in.

Many students indicated that the cat cadaver was more useful for understanding structure and interrelationships thus, reinforcing the findings of Downie and Meadows (1995), whilst the virtual dissection was more useful for understanding functions of structures.

> Cat cadaver and computer program should be used together as it helps identifying parts of the body. That's the disadvantage of the cadaver, it is hard to locate specific parts.
>
> Using both is excellent - the cadavers are better for forming an understanding of structure and computer are useful for understanding process (student emphasis).

However it has been suggested (Kinzie *et al*, 1993) that the use of a simulation is not the equivalent of performing a laboratory dissection, and that simply viewing a dissection on a screen does not have the same sensory experience or sense of personal discovery as a real dissection.

> You can see more doing it for yourself, notice texture etc., which can't be represented on a computer. Gives real experience. Can be a bit messy/smelly.

Quentin-Baxter and Dewhurst (1992) suggest that the benefits of computer-based simulation materials are that they offer a large amount of supporting and reinforcing information, and that students are able to work at their own pace. They recommend that students using computer-based simulations as alternatives to animal dissection should be encouraged to use them in groups to enable discussion about the material, paralleling the situation where students exchange information while carrying out a practical dissection. Our data show that 78% of students were using the virtual dissection materials alone, thus not having the opportunity to discuss the content with their peers. This may not be a disadvantage if the students are using the material for revision purposes, however care should be taken to fully integrate these materials into the classroom situation to maximise their usefulness.

The fact that a third of the students did not use the computer-based dissection materials was not due to an inability to access the resource, as the majority of students (98.5%) have access to the Internet. An issue may be that the use of the virtual resources is not compulsory - optional resources may have less attraction or perceived use than those which are specifically linked to assessment or examination components. This illustrates the value of offering a diverse range of materials to provide students with a rich learning environment - one where different views of content and a selection of resources to suit all learning styles are available should they be required. As data for non-use of the other online tutorials provided as part of the course were similar it is important that we investigate why approximately 25% of our students do not use any of the computer-based resources provided, not just the virtual dissection materials.

Implications

This study focused on the comparative value of real and virtual dissections in a first year biology course. While both resources were perceived to add value for the majority of students surveyed, a number of critical factors emerged relating to the implementation of computer-based resources within tertiary teaching programs. The questions for us to ask are: "Should we continue to replace the real dissections with virtual ones?" or "Should we provide both?" The trend for removing animal cadavers from laboratory classes is likely to continue with added pressure from an increasing student population and from within the local Animal Experimentation Ethics Committee (Wheeler, 1993). As some students are not using the virtual dissection materials, future investigations will endeavour to identify what mix of learning opportunities would best suit this large group of first year students.

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AN INSTITUTIONAL SYSTEM FOR DEVELOPING FLEXIBLE ONLINE LEARNING AND TEACHING ENVIRONMENTS

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Abstract

The paper reports on the state of development of a database/ server architecture for online learning and teaching environments, and progress towards wider adoption in the University. The strength of the Online Courseware Component Architecture (OCCA) comes from its grounded development in real curriculum projects, out of which a common denominator of online learning transactions has been derived. Students might use OCCA-based Web pages created by teachers that support open-ended questions, immediate feedback, learning histories, peer interactions or reflection on previous work. Other pages can be used as an optimised environment for teachers to review, assess and respond to student work. The different Web page structures provide many opportunities for creating templates and pedagogical exemplars that can be shared and re-used. The development has progressed from initial prototyping implementation, to be adopted as the project development environment for the Teaching, Learning and Research Support Department. It is now entering a third phase in which sites are being developed within local teaching departments. This paper summaries the state of development of OCCA and examines the fundamental shifts in the nature of the project and staff involvement accompanying these major phase changes.

Keywords

innovation, flexible learning, online delivery, learning objects, adoption

Background

Software reuse and sharing of online educational models is a major concern of higher education institutions. Significant funding placed into technology-based initiatives over the past five years has, however, resulted in low levels of dissemination beyond the originating department or institution (Alexander, 1999). Attempts to recycle existing computer-facilitated learning (CFL) developments by way of a national inventory found that there are insufficient data about CFL resources available (McNaught, Phillips, Rossiter & Winn, 2000). Previous national databases of CFL materials also did not appear to have significantly increased the take-up of CFL materials and strategies. It is likely that efficiencies will be achieved through increasing institutional adoption of courseware systems such as WebCT. While providing obvious benefits of standardisation, a recent survey of University of Melbourne teachers indicated that any single system would be educationally too restrictive and that some form of central support for supplementary approaches was essential (Fritze et al., 2001a).

Under a strategy to boost innovation, the University of Melbourne has run a major funding program for innovative technology-based curriculum projects over the last four years. While these explorations are natural for the early stages of technology evolution, ultimately more general-purpose platforms for staff use must emerge (Taylor, 1998). The development of Online Courseware Component Architecture (OCCA) is one such response that has been generated within the Teaching, Learning and Research Support Department (TeLaRS). OCCA has evolved directly from collaborations between teaching and TeLaRS staff, within a number of funded curriculum projects (Fritze, Welch & Ji, 2000). It has been possible for TeLaRS, given its position as the central educational technology support unit, to gather from a wide range of projects across the faculties, a common denominator of pedagogical requirements to underpin a generic learning architecture.

What is OCCA?

OCCA can be most simply described as a Web server, with additional functions for managing and storing teaching and learning 'transactions' (Figure 1). It comes with none of the pre-defined high-level pedagogical functions that typify standard courseware systems; rather activities are constructed using standard Web forms. A database stores 'work' done by students, groups or teachers. This might be a student's answer, a teacher's comment to a student, or even the state of an interactive simulation. Such information is represented within the database in standard 'State Description Protocol' (Fritze *et al.*, 2000) so that the format of the record is arbitrary. Such stored information is only useful if it can be recalled, so before any OCCA Web page is delivered, it is checked for special 'tags', which are replaced with appropriate data from the database records. In this way, text, checkbox/ menu values or other data saved from earlier pages can be embedded onto any other page. OCCA supports standard forms-based posting, as well as customised interactive programs written in Director, Shockwave or Flash, representing, for example, equipment simulations or discipline-specific tools. Using these low level operations, it is possible to create unique discursive environments for both students and teachers, not possible using current courseware systems (Fritze, 2001).

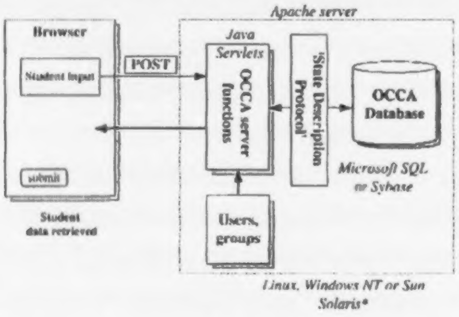

Figure 1: Structure of the OCCA server/database

A Student's View of OCCA

A student might experience OCCA-based online resources through a variety of Web page designs. Typical educational functions visible to the student are (Fritze, Kavnoudias, Kemm & Williams, 2001):

- activities – in which the student can submit work as individual or group, review work of peers, re-draft prior work and reflect on their learning;
- summaries of work done – the student may be provided with pages that represent learning portfolios, timetables of progress, histories of submissions or display responses of whole class or group;
- feedback – comments/ assessment/ annotations by teachers, peer reviews or conditional responses embedded within a question page; and
- interactive programs – e.g. equipment simulations or discipline interfaces such as a flow chart tool.

A Teacher's Perspective

OCCA presents no predefined teaching tools, so in addition to designing activities for students, other pages for teachers to monitor student progress and provide assessment & feedback need to be considered. There are many opportunities for reusing departmental page templates or copying techniques used in other subjects. Additional teaching activities are to administer users/ groups, adapt lectures/ tutorials in response to feedback from students and to train/ coordinate tutors where necessary.

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A Central Unit's Perspective

While the view of OCCA as an instrument to facilitate learning and teaching remains clear, less obvious is the manner in which TeLaRS involvement has altered (Table 1). TeLaRS is a department of the Information Division, providing support to all faculties in course development, educational design, programming, media production, learning resources, Web development, educational technology research and evaluation. In progressing from a phase of innovative prototyping, to adoption within TeLaRS and now the institution, the extent and nature of staff involvement has changed significantly, as have funding models and project policy. Moreover, these phases are tending to co-exist. For example there is a continuing role for innovative prototyping in parallel with centralised production and institutional adoption. Such parallel activities reflect fundamentally different involvement, funding models and stakeholder concerns that must be reconciled.

Phase	Description	Involvement	Funding	Concerns
Innovative prototyping	1997 - present Innovation through progressive prototypes, major shifts in technical, educational approach. Formative evaluation.	Only 1 or 2 unit staff, close collaboration with academic innovators in faculties.	Curriculum project grants, opportunistic and through research involvement.	High risk & personal time involvement, dependence on individuals, early attempts become obsolete.
Centralised production	2000 - present Adoption within TeLaRS as project production environment, software consolidated & extended. Project evaluation.	~12 TeLaRS designers, programmers, project managers working for academic 'clients'.	Independent funded curriculum projects.	Focus on individual projects more than common framework, system documentation, management of software versions
Institutional adoption	2001 - present Depts start to adopt for own use. TeLaRS manages centralised system & supports department IT units. Meta evaluation studies.	~10 Unit staff in systems development & admin, training & consultancy. More Faculty staff. Steering committee.	Corporate system funded centrally. Curriculum applications funded by faculties.	Mass usage. Reliability and performance, hotline and backup strategies. Increasing dependence on system. Authoring by widest range of users.

Table 1: Phases in the development of OCCA from the perspective of TeLaRS

Current Applications Within the University

OCCA is currently used in over thirty-five projects across the University. Most are one-off customised interactive online course environments created by TeLaRS for Departments, while others deliver simple questions or facilitate student essay submissions with customised marking templates for teachers. There are four collaborative projects involving other institutions in Arts, Law and Education. Eight projects now represent the start of institutional adoption in which Web development is undertaken within departments, with centralised system and staff support from TeLaRS. The Physiology Collaborative Learning Environment has been of particular importance in establishing the pedagogical potential of OCCA (Kemm et al., 2000). Evaluation reports from this project have indicated high levels of ease of use while involving students in pedagogically significant activities, such as re-drafting, self-assessment, providing feedback to peers, developing key concepts and reflecting on the learning process (Fritze et al., 2001).

Reflection on Adopting OCCA as a Generic Online Tool

OCCA as a development environment for creating customised courseware might be considered successful, based on its uptake in TeLaRS and evaluation of key curriculum implementations but for it to succeed as a generic institutional product, a major philosophical re-alignment is required. Table 1 reveals a number of areas of difficulty, not usually considered in the evaluation of single projects. Each phase through which the OCCA development has passed signifies a distinct change of 'control' or 'ownership'. Thus it becomes no longer practical for the 'innovators' to exert control over development directions as in the prototyping phase. Innovation threatens the stability required of software that must be applied in multiple projects by staff taking on a production role. On the other hand, a focus only on production of individual curriculum projects does not account for the requirements of a generic institutional system.

Sensitive management of these transitions is critical and must account for institutional and departmental politics and changes in individual involvement. Not only is the number of people involved with OCCA increasing but also new roles are being generated. The central unit must now coordinate new services such as corporate level system support, it must re-engineer systems and hardware, develop templates and resources for use in faculties and offer consultancy and development programs for faculty. A sustainable funding base must be established. There is no more important role than that of a central steering committee representing the interests of stakeholder communities and making pragmatic recommendations on development priorities and strategies. For a generic system such as this to succeed, policy should be informed by meta-evaluation and ongoing close collaboration with teachers at the coalface of its implementation.

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LEARNING ABOUT ONLINE LEARNING IN A DUAL SECTOR UNIVERSITY: REFLECTIONS, ISSUES AND CHALLENGES

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Abstract

The paper reports on an evaluation of the Online Learning in Tertiary Education (OLTE) subject in the Graduate Diploma in Tertiary Education program at Victoria University of Technology. The subject, which commenced this year, used both Problem-based Learning (PBL) and Action Learning (AL) teaching methods. In addition, students undertook a minor negotiated project in which they used online learning within a module and/or subject in which they were teaching. Face to face contact was reduced provided students engaged in the online forum for the subject thereby providing some of the flexibility students wanted. In addition to obtaining student feedback for the subject, the evaluation focused on the use of the mixture of teaching methods, student use of the online forum to extend their face-to-face sessions and the students' capacities to undertake the negotiated project. While we must improve the semester program and the support students need to complete their project work, there is evidence students found the PBL intensive program productive. Further, the students' use of the online forum demonstrated its potential, especially towards then end of the subject, but its use must be more aligned with the learning outcomes for the course.

Keywords

problem based learning, action learning, online forum, evaluation

Introduction

In 2001, the Online Learning in Tertiary Education subject commenced with a small cohort of 10 students. The subject, which is an elective in the Graduate Diploma in Tertiary Education course at the university, was initially designed to provide students with the knowledge and skills necessary to critically develop the use of online learning in their teaching, in line with principles of effective teaching in tertiary education (Biggs, 1999; Prosser & Trigwell, 1999). The subject was traditional in the sense that it entailed semester long project work. It was unusual in that a mixture of problem based learning (PBL) and action learning (AL) teaching methods was used and the PBL was used in an intensive three-day program. In addition, we intentionally reduced student face-to-face contact time for the AL meetings by allowing students to use an online forum to extend class discussions thereby being more inclusive of students who had work commitments which conflicted with the subject's face-to-face meetings. We wanted to increase participation and reduce the isolation of the students (Harisim, Starr, Teles, & Turoff, 1995)

The Online Learning in Tertiary Education (OLTE) subject

This OLTE subject deals with the design, development, use and evaluation of online learning in tertiary education. Importantly, we wanted our students to use online learning with students in their teaching programs and to critically reflect on that experience. While we wanted students to develop a basic knowledge of WebCT and MS FrontPage, the two main Web based tools used in the subject, we originally wanted to expose students to other applications such as (BSCW, NetMeeting, Photoshop etc). However, we designed the subject for students to learn about effective online pedagogy and critical reflection of their online teaching practices rather than to learn how to use various Web related applications. Still, at times, both were intertwined.

The following assumptions underpinned the curriculum of the subject:

1. Learning to teach online requires both developing skills in the use of Web related software and developing expertise in using the online environment to support student learning – a blend of technology and pedagogy (Hart, 2000).
2. Problem based learning fosters the development of information seeking skills, critical thinking, collaboration and problem solving skills (Boud & Feletti, 1997; Oliver & McLoughlin, 1999) that are fundamental to staff learning about online learning.
3. Learning activities that involve teachers working on their own courses, subjects or modules are more effective than those based on "pretend" courses. An Action learning approach where each participant is working on his or her own "live" courses is likely to be effective (McGill & Beaty, 1993).
4. Experience in using an online learning environment as a student is a prerequisite for using it as a teacher – a key to using online learning effectively, and teaching in general, is to focus on what the student does (Biggs, 1999; Checkering & Ehrmann, 1993; Housego & Freeman, 2000).

Consequently, we developed a curriculum that used problem-based learning and instructional techniques in a February intensive program, after which students undertook a negotiated project within an Action Learning framework throughout the semester.

Teaching Methods

February Intensive Program – Problem Based Learning

A three-day intensive problem (or practice)-based (PBL) program (Boud & Feletti, 1997) introduced students to the content of the subject. The PBL program focused on a design, development and communication problem related to online learning.

The general pattern for each day is set out below. WebCT was used to communicate the information found (bibliographic details and brief summary), to discuss issues raised before and after the second face-to-face meeting and to communicate a summary of the conclusions reached by the group. Based on the approach used by Pross (2000), the five-step PBL sequence, which students followed on each day of the intensive program, is summarised below:

Step 1: Students read the problem, which was also posted in WebCT prior to the session. We advised that one person in the group read the problem aloud prior to step 2.

Step 2: Students conducted a brainstorming session. The group considered the problem, identified learning issues and agreed on what information was needed. We suggested students answer the following questions:

1. What do you know about this problem?
2. What do you need to find out about the problem?
3. What are the significant issues (technical, social, teaching, learning, economic and political)? Think holistically.
4. What do you need to learn?
5. Where will you look for the information you need?
6. What are your priorities? What is most important to learn?

Step 3: The group identified essential issues all group members would investigate and specific issues one member in the group investigated on behalf of the whole group. Step 3 concluded with the allocating of tasks to people within the group.

Step 4: Reading, research and preparation - during the study session after lunch, group members use the resources provided to locate information relevant to the problem. During this session, students could approach several staff members who acted as "experts" or "information sources".

Step 5: Return and reporting - towards the end of the study session, each group reported their findings in a face-to-face meeting and then each student was required to enter a summary (bibliographic details and brief summary of significant issues and possible solution to the problem) into the WebCT Discussion folder set up for the day's problem.

Steps 1-3 were scheduled for the morning of each day of the intensive program, while steps 4-5 were scheduled for the afternoon of each day. The authors of this paper acted as facilitators for one of the groups. The PBL sessions took place at the Sunbury campus in study areas set up for staff to use as flexible learning areas. Consequently, students were provided pleasant working conditions and ample access to print based and electronic resources, including a CD-ROM of readings and tutorials for using WebCT.

Intensive Program – Instructional Sessions

The first two hours of each day of the intensive program were used for instructional workshops on using WebCT and MS FrontPage. The first session introduced our students to using WebCT as a student. The second session introduced students to using WebCT as a designer (and teacher). It also introduced students to using MS FrontPage. The last session focused on using the chat and online discussion tools of WebCT as a teacher.

Semester Program: Action Learning

After the three-day intensive program, an Action Learning approach was used throughout the semester in order to allow students to discuss significant issues related to their negotiated project, which focused on the design, development and use of online learning in a subject and/or module.

Students met in six two-hour meetings throughout the semester. Prior to each meeting, they were required to provide a small progress report of their work in the online forum. They could extend and/or further clarify their report at the face-to-face meeting. Primarily, the AL sessions were used to discuss issues arising out of the student's project work in order that the group may suggest strategies individual students could use to solve their problems. Students used the session to develop a plan for solving their problems. On occasions we conducted a small workshop on a specific technical and/or pedagogical aspect of the project work that a student had requested.

Participants

While the demand was high, we only enrolled ten students in the subject: Eight staff teaching in the TAFE division, one staff member from the Human Resource Department and one staff member from a university centre that provides multimedia support to both university and external clients.

Assessment

Summative assessment for this subject was based on the design, development and evaluation of a segment of a subject or module that uses the World Wide Web for delivery of materials and/or for communication between teacher and students. The assessment included marks allocated to participation in the face-to-face sessions and the online discussion as well as a final project report.

WebCT Tools Used to Support the Teaching of OLTE

WebCT was used to support the teaching of the OLTE subject. An online calendar was used to identify key dates and meeting locations. As already mentioned, information about the course and resources used in the PBL sessions was provided online and on CD-ROM that could be accessed from individual

Web pages and/or used as a stand alone resource. Students had access to a private email tool and the discussion forum was used throughout the entire subject. Finally, all the surveys in the subject were conducted online and students submitted their work through an assignment drop box. Student work was to be corrected and sent back to them as an email attachment. Marks and comments were to be placed in the online grade book.

Evaluation Methodology

The subject evaluation was designed to evaluate the implementation of the new curriculum using techniques most academics would employ as part of sound teaching practices.

Key Evaluation Questions

During the semester, we wanted to answer the following evaluation questions.

1. How will students relate to the use of problem-based learning during the intensive program? How prepared will students be for the semester program, especially the project work?
2. Will students have difficulty adjusting to the Action Learning approach after experiencing problem-based learning?
3, What significant issues will students bring to the face-to-face meetings during the Action Learning sessions? Will the combination of practical workshops and Action Learning sessions cover a range of topics associated with online learning?
4, What projects will students choose? Will they achieve the projects they choose? Are the tutors able to provide the practical support required for the subject?
5. How effective was the combination of face-to-face and online discussion in providing students with greater flexibility? Did students use the online forum in ways outlined in the curriculum materials?
6. How will staff work patterns change to support the course? Will staff be able to support students? What problems related to academic work will arise?

Data Collection and Analysis

Table 1 summarises the data collection and analysis techniques used to evaluate the OLTE subject. Students were initially surveyed using a modified version of the ICT skills and Access instrument developed by Oliver and Towers (2000). Simple online feedback surveys were administrated at the end of the February intensive program and the semester. There is increasing interest in analysing student contributions to an online forum (McKenzie & Murphy, 2000), we were interested in how participants used online discussion to support each other and extend their dialogue about the topics under discussion.

Method	**Purpose**	**Analysis**
Online surveys	ICT skills and Access survey at the beginning of the course.	Identification of potential gaps in IT skills and access
	Feedback survey at the end of the intensive PBL session	Identification of issues and problems with PBL sessions
	Feedback survey at the end of the semester.	Identification of problems Student perception of their learning outcomes
Attendance	Student attendance at face-to-face sessions was recorded. Observations of contributions were made.	Identify attendance and observe student contributions.
Online forum	Online discussion list was recorded.	Classification of purpose and contribution to online discussion of topics.
Changes during the subject	Key changes to the subject throughout subject were noted	Reflect on construction of new contexts
Interviews and phone contact.	Students who withdrew from the course were interviewed.	Identify key reasons for leaving subject
Assessment tasks	Student projects were retained and used as data.	Search of evidence of students achieving a ritical perspective of using online learning.

Table 1: Data collection and analysis techniques

Findings, Critique and Future Directions of OLTE Subject

Table 2 provides a summary of the findings of the subject evaluation together with suggestions for improving it. Further discussion of some of the findings, organised under the intensive program and semester program headings, follows the table.

Q.No	Summary of findings and issues	Future action
1	Positive feedback for PBL sessions. Comprehensive understanding of issues. Problems with group dynamics, role of facilitator, closure of each PBL activity and the timing of the intensive program.	Improve facilitator preparation. Set aside 30 min session for online reporting (needs lab access at the end of the day) Set intensive program one week earlier.
2	Irregular attendance at face-to-face meetings and submission of progress reports.	Allocate marks to submission of regular online reports.
3	IT knowledge and skills dominated semester program. Narrow range of topics addressed throughout semester.	Assess students IT capabilities. Develop more targeted and appropriate tutorials for building online materials. More structured reading list
4	While most students proposed a manageable project, few projects were completed within the semester.	Better manage negotiation process for student project. Further reduce scope of student project.
5	Engagement with the literature and each other less than expected. Reduced face-to-face did not lead to significantly more online discussion.	More structured reading list Greater use of readings within discussion forum Use online discussion to complete face-to-face activities.
6	Co-teacher did not participate in online forum and assessment as expected.	Better preparation for co-teachers. Alternate online moderator's role. Establish agreement on academic work patterns. Maintain weekly phone contact.

Table 2: Summary of findings and planned changes to the OLTE subject

The Intensive Program

Overall, students found the intensive program enjoyable and PBL productive. There were some initial problems with dynamics of one group, which after some minor changes were made there were no further problems. Students found the engagement of the problem-based learning cycles demanding but worthwhile.

> "It was very enjoyable, I was pleased that i added so much to my knowledge base re the topic. I look forward to the balance of the semester! Thanks!"

The intensive program took place in the right learning space.

> "Being able to bounce ideas off other people and the facilitator. The atmosphere on the campus and building 4 I found particularly stimulating."

However, the TAFE teachers had just started their semester program and so next time we need to schedule the intensive program a little earlier.

> "I generally found the sessions informative and rewarding but difficult to sustain a high level of participation when scheduled at this time of the year with classes about to start, or already started."

Importantly for us, students appeared to now understand online learning is more than simply placing lectures and/or resources online.

> "The need to be careful about how the online environment is used, and not simply as a dumping ground for lecture notes. Constructive alignment, and use of online as an adjunct worked best."

Another student added:

> "The need for a clear understanding of what you want to achieve, consideration of what is appropriate for on-line and the need for consistency across a subject area. Ideally, on line is not a replacement for other learning interactions but a support or adjunct."

Still, another student identified the value of working in the group.

> ".... PBL has exposed me to some broad based theories on principal teaching practices. As well the benefits of the discussions and feedback by the group."

Being new to PBL, some students wanted the facilitator to act as domain expert rather than simply provide information on the PBL learning cycle. They would have preferred fewer questions in analysing each problem and/or fewer problems. As we considered, we need at least three problems, one each on design, development and communication, we may need to make the PBL cycle more focused in order to lessen the impact of the following problems.

> "Lack of time. Perhaps fewer problems would have been better."
> "More intervention by mediator [PBL facilitator]. Fewer problems to give more time to focus on process."

The significant problem that was to stay with the class throughout the whole semester was obtaining the correct balance between learning about pedagogy and technology.

> "The morning sessions served largely to illustrate the breadth of my lack of knowledge of the software involved in on-line learning. Front Page, WebCT, Acrobat etc. Tangents inspired by questions from competent users only served to take up time and further mystify. Realistically, it made me question whether I can come up to sufficient speed in the software to do something meaningful in the subject. It was a major distraction and unsettling. Given that the afternoon sessions were given over the "pedagogy" & issues involved on line learning, the mornings would have been better spent in more structured tutorials on the software, with competent users allocated some other task. Three 3 hours sessions would have gone a long way to de-mystifying."

The ICT survey identified three people who were novice ICT and Web users whereas most of the students were completing the subject because they wanted to know more about online pedagogy rather than technology. However, in retrospect, we should have split the group and provided more support to the novices as they had difficulty developing those skills alone. Our lack of action had ramifications for the semester program.

Semester Program

Only seven of the ten students participated in the semester program. However, when interviewed, the students dropped out of the subject because of either family problems and/or increased work commitments. Only two students were in a position to complete their project at the end of the semester because of similar problems. Most students appear to need longer than a semester to complete the project work, which indicates we need to monitor and develop projects that are more limited in the ICT skills needed to complete them. Furthermore, the supervisor may need to receive a more structured plan for the student to complete the project. There is a balance here of providing the student with enough structure and support but also allowing the student to take control of their own project work.

The semester program was noted for the irregular attendance of students at the face-to-face meetings and, initially, low levels of contributions to the discussion forum. During the intensive program, the whole group decided to reduce the face-to-face meetings to six two-hour sessions but with the expectation that students (and teaching staff) would devote six hours contributing to the online forum. Later in the semester, when it was observed some people were unable to attend the face-to-face sessions, we allowed for an additional presence in the online forum to compensate for the non-attendance at the face-to-face sessions.

Throughout the semester, the following strategies were taken in order to increase use of the online discussion for the subject:

1. Teacher highlighted student postings that illustrated effective use of online forum
2. One teacher maintained a significant online presence at the beginning of the semester program.
3. Teacher sent private email to individual students enticing them to participate
4. Later in the semester a teacher phoned people who were not attending the face-to-face meetings or posting items to the online discussion.
5. Posting of an issue and/or paper requesting a student response (e.g. no significant difference Web site)
6. Teacher extended a face-to-face activity online (e.g. SWOT analysis of face-to-face and online learning) and requested students to respond in some way online.
7. Teacher reminded students that participation on and off line was assessed.

Still, it was difficult to get both the second author of this paper and all the students to participate in the online forums. There were technical problems.

> "Hi Everyone As one of the main culprits I will tell you that Murphy's law has a lot to do with it!!!! My computer's hard drive crashed at home. The laptop is not net connected as I was off sick for nearly a week (with the lap top) when IT came to do it, so now I'm bottom of queue. The computer at work is fine (touch wood!), but I have been at meetings every non-teaching minute dealing with relocation of marketing to Sunshine, work plans, my reclass and other union stuff.!!!!!"

Some students identified the tendency to procrastinate over our responses, which often results in no response at all.

> "Threats and Intimidation? Just kidding, but seriously I think it may be a bit of both of what you said, and the other idea I had was that it maybe it's too easy and people just say to themselves "well I'll do that a little later, after I do this other thing" and then they never get around to doing it because 'stuff' got in the way. My only other suggestion is that you could do what I do in my own classes when assignment deadlines and requests are not met start removing marks."

Another student identified the right of people to observe others but not participate in the learning activity. The student also acknowledges that writing a reply to a posting can be hard work, especially as your mistakes and immature comments are public for the whole semester.

> "Speaking from a personal point of view, the problems I have found are probably combined - Its very easy to go in and see what's going on and make sure that you are keeping abreast of what others are doing, but in order to produce some work you must have the time to actually sit and think and work through some issues and do some research - and this part is harder. I'm sure its all about organisation and also perhaps letting go of some thoughts to the discussion. If a student is unsure of his/her abilities then its just a matter of giving themselves time until a problem can be thought through in order not to appear too silly - unfortunately for that student time is usually a luxury that they cannot afford. Motivation is the key and I think the up side is that by providing deadlines and reminders, the student usually responds and rises to the challenge."

The second author of the paper also did not post responses to the discussion list for similar reasons. Consequently, we will need to develop a common approach to illustrating sound online teaching practices prior to commencing the subject next year. Towards the end of the semester, students used the online forum to seek support from their peers and to herald their achievements as in the following case.

> "I've actually released my on-line course to the students last week. Hip-hip hooray for me! Met them last night and got good response."

Students readily provided support and feedback to each other

> "[Student's name], I think your survey seems to cover most of the major issues. It looks great. One thing I did think about was that if the students were positive about the online delivery, then maybe we could ask them which of their subjects they felt would be best suited in their opinion to online delivery."

In the following case, people were starting to show the signs of wear as they struggled to complete their project.

> "Hope you're not all overloaded with as much work as I am at the moment. Hard to find time to have a life. Please find attached my progress report. I hope others have more success than I have had."

> "[Student's name], I wouldn't be too discouraged, as this response from your students appears to be fairly typical (take our class for example). I think it's harder for us as teachers when we put "the old heart and soul" into a project and it doesn't meet our expectations."

> "I agree with [students' name] a hundred percent - we are not to be blamed for a project's failure. As a matter of fact, there is no such thing as a failed project. If it did not meet its objective the first time, one should always reflect back, do some analysis, and then do some corrective actions to rectify them. ..... By the looks of it, you are into that process already, you know why it did not do so well initially, and you have some corrective actions in the offing."

From a teacher's perspective, it was nice to see a willingness to move on and improve one's work represented in the text, although it was unlikely the sentiment was solely due to the student's experience in the subject.

Still, putting aside the problems associated the negotiation of the student projects for a moment; clearly staff in the TAFE division had difficulties undertaking any additional studies. The introduction of the Learnscope flexible learning professional development program provided some of our students with computers but insisted students participate in their program irrespective of other studies they were undertaking. It again added to the students' workload, although clearly the students with few ICT skills would have benefited form participation in the professional development activities.

The more significant problem was the lack of university wide practical support for staff, which was exacerbated through the coincidental introduction of training packages into the TAFE programs. Affected students were required to revise the teaching program and develop new teaching materials. Undertaking an online project in addition to this work proved too much for some. TAFE managers need to develop more effective ways of supporting staff who undertake part time study at the university, especially given the priority of flexible learning within the TAFE sector. As one student stated: "My issue for next week - getting it done! No more, no less". The teaching team will need to provide greater support to the students both on and off-line next year.

Conclusions

The use of problem-based learning in the February intensive program provided students with a good start to the issues related to online learning but did not prepare them for the practical aspects of building online learning into the subjects they teach. The instructional sessions need further development within the subject and we may need to provide better-targeted self-instructional material. Online learning is both technology and pedagogy. In retrospect, the application of Action

Learning was not done well due to the irregular student attendance at the face-to-face meetings and the lack of use of online forum early in the semester. We also need to better manage the negotiated project, especially in its early stages.

The online forum can help us share information, provide support and/or exchange views on issues and strategies related to using online learning. However, subject tutors must illustrate benefits of using the forum to the students early in the semester and will likely need to expend significant effort fostering online communication between participants. Aspects of the Action learning cycle need assessment and we must better align the role of the discussion forum with what the students need to do to fulfil their role within the AL cycle. Student use of the online forum later in the semester, and at times during the semester, illustrated how useful it could be to providing students with support, information and/or different conceptions of online learning. The option of participating online when the demands of the student's workplace interfere with their study is the type of flexibility we must maintain, but nonetheless, use more effectively.

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EVALUATION OF ACHIEVEMENTS FROM COLLABORATION IN A LEARNING TECHNOLOGY MENTORING PROGRAM

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Abstract

Academic staff development that is concerned with how to incorporate online learning into university courses must address two issues: online technology and its educational implications challenge many staff to review their attitudes to their own teaching, and working with online learning technology lends itself to a team-oriented, collegial approach to developing and operating academic programs. One approach to these issues is to embed staff development for online teaching and learning into specific learning resource development projects - where staff can share the experience of introducing technological change into their courses, where they can support each other to put new tools, skills and strategies into practice, and where they can get continuous feedback on the effectiveness of online learning in an applied setting. This paper reports on the processes and outcomes in a Learning Technology Mentor (LTM) program employed to advance online learning at RMIT University in this way during 1999 and 2000, through a case study of the implementation of this combined staff development and resource development program in the University's Faculty of Life Sciences.

Keywords

mentoring, online teaching and learning, staff development, courseware development

Staff Development to Support Change

We should not underestimate the difficulties involved in innovation and change. Marris (1986) parallels the sense of loss during bereavement to the resistance one can feel when letting go of known ways of doing things and embarking on new strategies. For many academics the increasing emphasis on the use of information and communication technology for administration, research and teaching is highly threatening. We need to recognise these fears and devise plans that build staff confidence and motivation, and provide adequate support and training opportunities.

Staff development can no longer be a pleasant 'cottage industry' on the fringes of academe or the enthusiastic enterprise of a few individuals supported by 'soft' money. Capable staff who can work productively with new Knowledge Economy technologies are central to the sustainability of the modern university. Effective staff development must be positioned both at the centre of university operations and at the same time in close proximity to the work context, needs and perceptions of teaching staff. This is a demanding challenge. Staff development programs that are successful in meeting the needs of complex modern Australian universities need to be supported strategically (and financially) by their own universities.

In a recent investigation into the factors supporting the adoption of computer-facilitated learning (CFL) at Australian universities (McNaught, Phillips, Rossiter & Winn, 2000), six key issues in staff development were strongly voiced:

- The appropriate balance point between centrally provided and local staff development services needs to be determined in each university. Central services can be more clearly linked to university priorities; faculty or department services can be more in touch with local needs.

- As technology becomes more mainstream, support services need to be scaled up. This involves deciding on the level of support that can be afforded and the model of support that is most apposite. The educational design and evaluation, technical, and media production support services that universities currently have are under strain. It is unlikely that the existing examples of good practice in courseware at each university will be sufficient in themselves as models for other staff to use in developing new subjects or renewing their existing subjects. However, by modelling good practice themselves, mentors can assist colleagues to make optimal use of resources.

- A follow-on issue is determining the optimal relationship between staff development and production support services. Again, this needs to be decided in each university context.

- Even if an integrated model of professional development is adopted, there are still many professional development providers at most universities. Mapping the services of each provider and ensuring reasonable coordination is increasingly important as the need for support services scales up.

- Academic and general staff work load is a key issue. Careful work planning to ensure that staff have time to learn new skills and manage new processes is essential.

- We are in a time of rapid change. It is important that professional development support be flexible, appropriate and adaptable. It should make sense to staff, be linked to practice and be appropriately timed.

Over the past few years, RMIT has made a substantial investment into the use of online learning technology (e.g. Fallshaw, 2000), aimed at improving the quality of programs by reviewing their educational design and adding greater flexibility to modes of studying them. This initiative, called the IT Alignment Program (ITAP), has involved investment in infrastructure, enterprise computer-based systems, Library resources, staff development, and program and course[1] renewal (RMIT. Learning Technology Services, Online). RMIT has sought to move on several fronts at once, and many of the policies and processes that have been developed are still being refined.

The Distributed Learning System (DLS), one part of the ITAP initiative, offers staff a set of online tools to assist staff in renewing their programs and courses. An earlier report on RMIT's work (McNaught, Kenny, Kennedy & Lord, 1999) describes the toolset, early implementation experiences and early evaluations. As the name of this system suggests, ownership of such an approach must become distributed across the organisation. Therefore the shared role of centrally-based and faculty-based support for staff development and for the development of online learning materials and strategies is critical to achieving change in academic practices and program design. The following case study describes one project that sought to combine the benefits of both the central and distributed approaches to support (Hughes, Hewson & Nightingale, 1997).

The Learning Technology Mentor Program

A Learning Technology Mentor (LTM) program at RMIT ran from mid-1999 to the early part of 2001. It was conceptualised as part of the IT Alignment Program, and was jointly supported by the University's central Learning Technology Services group and the seven faculties of the University. The case of implementation in the Faculty of Life Sciences is described here.

The LTM program provided for academic staff in the Faculty of Life Sciences to have one day per week time release over one semester, in order to:

- learn how to use the University's recently established online education system,
- design and implement online learning in the Faculty's education programs, and
- promote and support similar activities among colleagues in the Faculty.

The aim of making a significant investment in learning technology mentoring by academic staff—rather than establishing a specialist online design and production unit to service them, for example—was to achieve widespread adoption of online learning as part of effecting a change in the culture of academic work. The intention of mentoring was to develop approaches to online education that originated within, and had close affinity with, academics' knowledge and experience of education in disciplinary areas and professional fields of study, and thus could influence not only new learning experiences but also new teaching practices.

The staff selected were a mix of learning technology enthusiasts who volunteered, and candidates identified for this type of professional development by senior staff in the Faculty and its Departments. Altogether 18 staff (out of a total of around 150 staff in the Faculty) were offered the opportunity to participate in the program, with at least two from each of the Departments in the Faculty. Eight staff took on the role of a Learning Technology Mentor in semester 2 1999, 12 in semester 1 2000, and 15 staff between semester 2 2000 and summer 2001. Time release of more than one semester was required to achieve useful outcomes in some cases, so by the end of the program, six staff had six months' experience as learning technology mentors, six staff had one year's experience, and five staff had 18 months' experience.

The work of Learning Technology Mentors was scaffolded by means of:

- contracts mapping out the work planned for the semester, as agreed among the mentor, the mentor's supervisor, the Faculty's Directors of Information Technology and Teaching Quality, and the University's Learning Technology Services group;

- a program of formal staff development for mentors on planning online education design and using learning technology software, run by the University's Learning Technology Services group; and

- ongoing management and coordination of selection, contracting and progress reporting, in alignment with University and Faculty strategic priorities for teaching and learning.

The contract that was agreed upon had elements of a personal learning contract, elements of a courseware production contract, and elements of a contract to provide training services. The transfer of funds to support time release for mentoring work was conditional upon each mentor's periodic evaluation of progress towards these different kinds of outcomes.

The formal staff development that LTMs undertook was about a week long, in both three-day workshops and in shorter sessions. Some of the key topics related to RMIT's vision with respect to the university's position as a major international technological university. The Boyer (1990) Scholarship model has been used for some time as an integrating model for all RMIT work; within this framework, the evolution of the University's Teaching and Learning Strategy over the last few years, and the structure and function of the IT Alignment Program, were discussed. The program and course and renewal guidelines framed at Faculty level were discussed with a particular emphasis on the concept of graduate capabilities. The principles of course design were then enacted through training in the DLS toolset and consideration of how the use of the DLS tools related to the renewal of courses. Additional sessions covered a range of practical 'hands-on' sessions, as well as workshops in areas such as assessment and evaluation strategies for online learning, student induction methods, finding and managing digital resources, project management and copyright.

Management of the LTM program entailed stage-by-stage negotiation of the program 'on the fly', in a dynamic and occasionally dysfunctional institutional environment, among managers of the University's central service units, academic administrators at Department and Faculty level, and the individual academics.

Evaluation here of what was achieved from this highly collaborative process is based on reflections by the University LTM manager and the Faculty of Life Sciences LTM coordinator on the process of managing this staff development and courseware development program. These reflections in turn are based partly on formal reports filed in early 2001 by ten of the Faculty of Life Sciences mentors, and partly on observation of other changes that occurred over the period of the LTM program.

Framing Mentors' Understanding of Online Learning

The first six months of the LTM program in 1999 produced diffuse and uneven outcomes, with little clear evidence of the benefit of the LTM program to the core teaching activities of the Faculty overall, although there was very encouraging personal-professional development among a few of the academics involved. The Faculty responded by engaging more closely with the University's general ITAP strategy and policy statements, in order to extrapolate from them some objectives to sharpen the focus of mentoring work in implementing change in the culture of teaching and learning in the Faculty.

From the start of 2000, the activities of Life Sciences Learning Technology Mentors were expected to reflect an understanding that the project's objective was to advance online learning in ways that strengthened the viability of program operations, contributed to internationalising the curriculum, helped to integrate learning in workplace settings, and achieved other strategic outcomes for programs, such as:

- improving the management and presentation of experts' subject knowledge,
- extending the range and power of learning experiences in a field of study, and
- innovating educational program designs complementary to new fields of knowledge.

Focusing on Quality and Strategy

Outcomes from the second six months of the LTM program were noticeable in terms of broadly based advances in mentors' own skills development and in the online education awareness and skills of their colleagues. But there was not yet a significant presence of online learning environments available for student use, and among those that were, a number did not address the University's online education design guidelines or online publishing standards, even though formal training sessions for mentors had covered these. The importance of getting returns from mentoring increased the need for greater accountabilities among the stakeholders.

The Faculty convened a meeting of all its mentors to get consensus on appropriate messages about 'quality' that they could communicate to their colleagues, and also some messages that the Faculty needed to communicate to the central service units, related to operating system performance and the efficacy of training sessions.

In another measure, the University advised Faculties to short-list strategically important education programs and direct mentoring efforts more intensively towards developing online learning in courses in these programs. Accordingly, eight of the 15 Life Sciences mentors were selected for their capability to work on programs that the Faculty had designated as having special strategic importance, in this phase of the LTM program.

Moving Beyond Mentoring

During the third semester of the LTM program it became increasingly obvious that this approach to advancing online learning was reaching the end of its life cycle in the Faculty of Life Sciences. Time release for mentors and their colleagues, always a somewhat fluid concept, was being taken up more and more to resolve underlying issues of quality and strategy in Faculty programs. Indeed, some of these issues were brought to the surface by the impetus to renew these programs for online learning.

It was also clear that a mentoring approach was not going to be effective in influencing every academic's learning technology skills and practices, and the Faculty's limited resources might need to be redirected away from this LTM program to other approaches, in order to shift the remaining staff.

The University LTM program manager and the Faculty LTM coordinator convened a meeting of all Life Sciences LTMs to determine how to sum up the outcomes in a way that could best inform future staff development and program development initiatives. Five major outcome areas were identified:

1. *Content development*. At the outset of the LTM project, approximately 25% of all Life Sciences courses had been developed for online learning to any significant extent. By the end of the LTM project, approximately 50% of Life Sciences courses were represented in the Distributed Learning System, either developed sufficiently for student use, or at some preliminary level of development. One outcome of the course-by-course approach to renewal for online learning was that the Faculty decided to undertake a major review of online learning in all its online courses, on a program-by-program basis, so that discussions about the quality and strategic dimensions of online learning could be better integrated with other whole-of-program management issues.

2. *Student learning experiences*. The LTMs reported increased student use of their course sites (as monitored with DLS course administration tools, and through student feedback mechanisms). Several explanations were advanced: they themselves had become more effective online teachers; their students had become more appreciative of online learning as an enhancement of other modes of learning; the student population as a whole was a more sophisticated Internet user group than ever before. The general level of student feedback was positive, but it also indicated a need for some carefully planned evaluation studies that the LTM project itself was never designed to conduct.

3. *Staff interest in learning technologies*. LTMs estimated that between 50% and 80% of staff in their departments were now engaged in teaching online to some extent or developing a site for online learning. This was borne out by the increase in courses with a presence in the DLS. While an increased take-up of online teaching and learning cannot be attributed just to the work of LTMs, this project must be regarded as the most significant factor by far in this outcome. The Faculty laid plans for a Learning Technology Leadership group to continue the momentum of online learning development that was initiated by the LTM project.

4. *Personal and professional outcomes*. All LTM reports acknowledged elements of personal growth and enjoyment, despite an increased work load. As well as acquiring capability with learning technology, these academic staff valued the opportunity to learn and hone general mentoring skills. Four LTMs reported publication of their work at conferences. Several reported increased collegial contact within the Faculty and two reported making collaborative contacts with other universities as an outcome of participating as an LTM. Being an LTM did

not lead to worthwhile outcomes in all cases, however. In some instances, placing a high value on other competing claims on work time, or placing a low value on accountability and teamwork, were factors that diminished a staff member's achievements as a mentor. The recognition and rewards of teaching and learning with technology were sufficient motivation for some but not all participants in the LTM program.

5. *System and program performance.* During the period of the LTM initiative, the stability and reliability of the DLS infrastructure improved significantly off a low base, and the work of the LTMs made a major contribution to debugging the system and monitoring its performance on behalf of other teaching staff during this time. The support structures at both Faculty and central levels were generally rated well. However, within the Faculty the upgrading of IT infrastructure was not well coordinated with the selection of mentors in every case; this resulted in a few staff entering into LTM contracts without being provided with adequate computing resources, and pointed up areas for improvement in IT service planning.

Learning the Lessons of the LTM Project

It is now two years since this staff development approach began and we have begun to formulate our experience as a series of questions that need continuing attention. These questions are offered here to assist others in planning and evaluation of their own staff development schemes.

Did we get the balance between central support and local action right? Forming and managing relationships of trust and shared purpose is not easy, but is essential if productive work is to be achieved. The IT Alignment Program was a central university initiative, but Learning Technology Services tried to emphasise the pivotal role of Faculties in the design of the LTM program. The Faculty of Life Sciences perceived benefits for its staff development and course development, and thus was willing to collaborate in the broad processes, and to commit a significant level of specific coordination effort, to achieve the outcomes described. Not all Faculties sought these outcomes nor chose this same degree of engagement; implementation of the LTM program was not uniform.

How practical is time release to replace part of the work of an academic in a meaningful way? The LTM program was premised on funded time release for academic staff to be mentors. A few of them held quite senior positions, and all of them had other important teaching, research and / or academic administration duties. Some of them ended up doing their LTM work on top of their normal activities, or redistributing duties to equally busy colleagues, because of the difficulty of finding and briefing suitable replacement staff for short-term, part-time appointments of this nature. The dedication of LTM participants in working flexibly to change their academic practices was impressive, but this aspect of the program was just not sustainable in every situation. Being successful in implementing online education became associated with redefining priorities, becoming very skilled at time and task management, and building synergies in teaching teams.

What is the optimal scope of a mentoring program? The legacy of this project was two or three academics (about 10% of academic staff) in each Department who had actively taken part, whose academic practices were influenced by the experience, and who remained as models and a point of reference for their colleagues. In retrospect, this seems to have been a reasonable proportion of staff. The term of the LTM program was not fixed from the outset; an answer to the question of who would be able to work effectively in this way and for how long, only became clear as time went on. As noted, support for mentoring did not become an entrenched process. LTMs, the Faculty and Learning Technology Services itself were required to renegotiate roles and initiate other approaches to meet the expectations the project had raised, when it finished.

What rewards are there for a mentor? Those staff who participated certainly added substance to their teaching portfolios, and thus enhanced their prospects for academic promotion on this ground; but they had to evaluate the efficacy of investing their effort in this area at the same time as the University's expectation remained constant that they produce research outputs in their discipline area also. Most participants weren't likely to find time to pursue qualifications in staff development or courseware production, and so could not take advantage of accreditation programs that would formally recognise their expertise as LTMs. Participants had to have a desire to move themselves professionally into an area of continuous change and challenge; if so, they were able to derive considerable personal satisfaction from the opportunity to redefine productive and satisfying academic work.

How feasible is the concept of building up staff capability across a whole institution? How patient is the modern large university about investing in the future of its academic staff capability when there are real immediate needs for education program restructuring and renewal? We face pressures to increase the amount of 'quality' 'marketable' online courseware, but is it inevitable that our response is to short-circuit academic staff development and emphasise courseware production by specialist media production staff instead? Can we get this balance of short-term and long-term goals right? This is a particularly difficult issue in many universities at present, where national government funding is dwindling and the opening of global markets is a strengthening prospect. Putting content online is faster and easier to achieve than thoughtful and innovative renewal of courses and programs. Learning Technology Mentoring is not a quick fix. Building a culture of excellent process and practice in online teaching and learning takes longer, but may lead ultimately to greater competitive advantage.

We have no definitive answers to these questions. We seek to reflect on all of them, and work continuously towards more refined and sophisticated approaches to staff development and program development. What is our advice to other universities thinking of mentoring programs for online learning? Moving at once on several fronts—policy, infrastructure and support—is absolutely essential. Working across the university in all faculties and departments is also essential, so as to develop local ownership, build generalised capability and maintain productivity in a shared context. Without the substantial investment in time, money and relationship management that large-scale staff development programs demand, there is unlikely to be significant change in effective use of online learning on a Faculty- or University-wide scale.

The LTM program has left a large legacy, above and beyond the quantum of courseware that is now online, and the concomitant improvements that online learning has brought to student learning experiences, new curriculum development and program operating efficiencies. The academics who have given time to being mentors have an expanded network of colleagues, and they are now competent-to-advanced users of learning technology. The Faculty of Life Sciences has established a cohort of academic staff who are important human resources in its continuing implementation of online education for strategic advantage, and has also built its expertise in managing the related professional development and program development processes. The University has had hard-won, hands-on input into the continuous improvement of its system for managing online learning, and an opportunity to extend the scholarship of teaching and learning online.

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Endnotes

1. RMIT, like several other Australian universities, has adopted the nomenclature of programs and courses: 'program' for the university's provision of an entire student educational experience leading to a formal qualification, and 'course' for the component subject, unit or module.

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DEVELOPMENT OF A MULTIMEDIA PROGRAM THAT CROSSES TRADITIONAL DISCIPLINE BOUNDARIES

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Abstract

This paper presents an overview of the development of a multimedia program called "The Patient Under The Microscope", which explores the key role of cells in health and disease. This CD-ROM-based program was designed to meet the learning objectives related to cell biology, histology and pathology in medical and paramedical curricula at The University of Melbourne. As such, it demonstrates the link between changes at the cellular and molecular level and the signs and symptoms of disease in the patient. It is used for computer-aided learning (CAL) based tutorials, as well as serving as a resource supporting more traditional microscope-based practical classes, lectures and problem-based learning in the medical curriculum. The program is now an integral part of a variety of courses involving First to Third Year level students within the Faculty of Medicine, Dentistry and Health Sciences. It is currently used by more than 1000 students per year and its usage is expanding.

Keywords

multimedia, cell biology, histology, pathology, clinical problems

The Need for the Program

Development of this program was commenced at a time when medical education was undergoing revolutionary change on a global scale. This change is ongoing and involves three fronts: the widespread adoption of problem-based learning, the introduction of multimedia technology, and the growing impact of cell biology.

Traditional methods of teaching are being discarded as inefficient and unchallenging for both students and teaching staff. Instead, medical schools worldwide are turning to problem-based learning (PBL) (Barrows & Tamblyn, 1980). At the same time, formal staff-student contact time is being reduced in favour of opportunities for self-directed learning. This approach is in line with the recommendation of the General Medical Council for the adoption of methods which promote "learning through curiosity, exploration of knowledge and the critical evaluation of evidence" (GMC, 1993). PBL blurs the boundaries between disciplines and allows students to acquire an integrated knowledge based on their experience of the type of problems they will encounter in their professional lives. Furthermore, PBL addresses the issues of curriculum overload and repetition, and reduces the need for rote-learning. It is thus a sound educational strategy, based on research into how students learn most effectively (Walton & Matthews, 1989).

Multimedia technology is also being widely adopted and utilised to stimulate learning by enhancing the role of reason and imagination. Computers offer the ability not only to organise and store large databases, allowing ease of access to an impressive amount of information including images and animations, but also to allow self-directed, self-paced learning with opportunities for feedback at critical points in the learning process. Not surprisingly, overseas experience has shown that the introduction of PBL has increased the demand for computer-assisted learning. Clinical reasoning skills and basic biomedical knowledge are acquired in PBL by discussing cases with fellow students and by consulting appropriate resources. However, to be effective, students must be provided with a framework as an aid to assimilating the enormous amount of available information. This is a major aim of the program outlined in this paper.

Medicine itself is also going through revolutionary change, particularly in the field of cell biology. Rapid advances are being made in the understanding of disease at a molecular and genetic level. This new knowledge is bringing with it improvements in diagnosis and treatment. It is therefore essential that students are able to understand these advances and the way in which they are impacting on patient diagnosis and management. Because of the central role of the cell in determining how disease is expressed, histology and pathology offer the crucial links between events taking place at a cellular and molecular level and the manifestations of disease in the patient. Understanding this link will be essential to the medical practitioners of the future. The program described in this paper provides a resource for exploring the link between cellular and molecular events, and the clinical expressions of disease.

Project Concept

By focussing on the structure and function of the human body at the level of cells and tissues, this program seeks to provide a framework for understanding clinical problems. Images obtained from normal and abnormal tissues are used to simulate diagnostic examinations such as would be performed on biopsy specimens from patients. These images are complemented by diagrams, animations, text and appropriate key questions designed to direct students to establish their own understanding of microscopic anatomy and patterns of disease. By combining this with macroscopic images of diseased organs or tissues, together with common presenting complaints, symptoms, clinical signs and diagnostic investigations, the student is guided to an appreciation of how the clinical manifestations of disease arise and can be interpreted.

Educational Objectives

The Patient Under The Microscope was designed for use by students in conjunction with the systems-oriented learning environment currently being used at The University of Melbourne. This CD-ROM-based program takes the form of modular teaching units which can be used as a self-paced learning resource, incorporating formative assessment.

The program aids students in the fundamental task of integrating knowledge. By exploring the relationship between structure, function and malfunction (patterns of disease) the program provides a set of unifying principles that complement, enhance and extend the problem-based, system-oriented approach adopted by the medical faculty in combining the basic pre-clinical subjects.

A series of modules have been produced which allow students to explore a topic of interest, related to a clinical problem. An example of this is skin cancer. Interactive tutorials allow students to study the histology of skin, including the nature of the epithelium, the way in which the epithelium is adapted to its functions, and the dynamics of the epithelial cell population. Students are able to view images of skin selected to illustrate the relationship between structure and function. The students are then led on to explore the changes in cell morphology and behaviour associated with damage caused by solar radiation, as well as viewing macroscopic specimens of skin cancer.

Regular self-assessment provides important feedback to the student at strategic points in the learning process, while learning remains essentially self-directed and self-paced. The modular units are designed in such a way that students are able to begin at any level and move forward to develop their understanding of new concepts, or move back to revise basic information which may need reinforcement to fully comprehend the clinical problems they are exploring. This is very useful as students reviewing a particular area are not necessarily at the same point in their course, or in their individual development.

Formative assessment has been incorporated into the tutorial programs in such a way as to encourage clinical reasoning. At the end of modules, self-assessment tasks called "Diagnostic Decisions" are offered. Alternatively, the user may choose to attempt a "Multiple Option Quiz", which is programmed to function like a multiple-choice test. At the end of the quiz a score sheet is produced with an opportunity to check on the answers. Self-assessment of this type is particularly sought-after by students engaged in PBL. A special effort has been made to ensure that the goals of formative assessment are matched to the goals of summative assessment, to further reinforce student learning (Newble & Jaeger, 1983).

Scope

The program is divided into an INTRODUCTION and four colour-coded levels: CELLS AND BASIC TISSUES, ORGAN SYSTEMS, DISEASE PROCESSES and CLINICAL PROBLEMS. The INTRODUCTION explains issues such as the importance of thinking in terms of planes of section, image resolution and the roles of light and electron microscopy. The CELLS AND TISSUES level includes information on cell organelles, cell surface specialisations and basic tissue types. The ORGAN SYSTEMS level contains information on the way specialised cells and basic tissues are organised to form entities such as the skin and the cardiovascular system. The DISEASE PROCESSES level outlines basic pathological processes. The CLINICAL PROBLEMS in the final level have been selected to illustrate basic principles, illustrating how cell injury and reactions to injury are manifested clinically.

The scope of this program is therefore unusual. No similar resource exists, either in a multimedia or conventional textbook form. A reasonable volume of educational material is available to assist with the teaching of histology and pathology, including computer-aided learning programs. However, in no case is the teaching of histology and pathology fully integrated in this way. Current texts and multimedia programs of pathology assume a basic knowledge of histology and cell biology, whereas histology texts and programs do little more than hint at pathological processes. We have found from experience that students are often unable to make the links between the two and with clinical practice.

Interface and Navigation

The program is designed in modular units. Gateway screens within the levels direct students to related modules. Within each module there is a linear progression between screens which eventually returns the user to the initial gateway screen. On launching the program the user enters the Home Screen and is presented with a choice between the INTRODUCTION, any of the four levels of the program, or a QUIT button for exiting the program. Any of the levels can be accessed directly by clicking on the appropriate button which activates the microscope-based navigation zone on the left of the screen. Clicking on the microscope stage displays a menu of module gateways.

Throughout the program, a button displaying the program's microscope icon is located in the lower left of the navigation zone. Clicking on this icon will always return the user to the Home Screen. In addition, a directory icon is always accessible. Clicking on this icon opens a window which displays definitions of terms and directs the user to further information within the program or in course-related textbooks. Interactivity within the program includes the use of active text linked to definitions and overlays to clearly indicate key features of images. Animations show the consequences of structural and functional changes. Users are also challenged to "build-your-own" organelles or tissues, or follow a disease process.

Implementation

The program has been aimed primarily at medical students and incorporated into the curriculum of the medical course. However, the interactive self-paced tutorials and self-assessment have also proven to be a valuable resource for students in paramedical courses, such as dental science, biomedical science, optometry and physiotherapy. Modular units have been selected by staff for use as CAL-based tutorials, introductory material for practical classes, course-specific material reinforcing or expanding upon lectures, material formally incorporated into problem-solving exercises, and bridging courses for overseas, graduate and lateral entry students, etc.

Evaluation

The program has been evaluated by means of expert review, student questionnaires, direct observation of student use, focus group interviews, individual interviews and formal assessment measures. All users agreed that the program was easy to use. In response to the assertion that "the computer-based multimedia program helped me to learn effectively" a score of 4.6 on a scale of 5 was achieved. Over 80 percent found the CAL "interesting" or "extremely interesting" (i.e. scored 4 or 5, respectively, on a scale of 0 to 5). Staff noted that students were readily engaged by the program and often spontaneously explored modules beyond the requirements of the class, or even of their course. There was also a high level of demand to access the program outside class hours. Above all, the questions raised by students often indicated a deeper understanding of topics than had been the case previously.

Conclusions

Morphology has traditionally provided an explanation of clinical signs and symptoms, whether at a macroscopic or microscopic level. There is now an increasing need for extension of this process to provide an explanation of the pathophysiology and molecular mechanisms of disease. The first steps in this integrative approach to the teaching of histology and pathology have been taken through the development of a new interactive multimedia program. The project outlined here has achieved an unprecedented degree of integration of basic and clinical sciences and allowed an emphasis on concepts that cross over disciplinary barriers.

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DEVELOPING STAFF IT SKILLS IN THE ARTS

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Abstract

In the Arts, we've been a bit slower than some Faculties in coming to terms with the increasing use of IT&MM in teaching. In this paper, we reflect upon changes we've sought as a way to encourage greater involvement with online technologies. Specifically, we look at staff development as a central component to changes and map out where we've gone and take a brief look at where we are headed.

Keywords
staff development, professional training, university policies

Introduction

Despite the emphasis in Australian higher education on online teaching and learning, many academic staff still struggle to understand and use digital technologies. For a significant section of the university, information technologies and multimedia (IT&MM) are seen to be complex, untried and pedagogically unsound (Salter & Hansen, 1999). Non-participation in online teaching, however, has serious consequences through the loss of valuable experience and expertise in matters regarding IT (Bennett, Priest & McPherson, 1999). Truly critical discussions regarding the influence of IT&MM throughout university communities need a wide participation of informed academic staff members.

In the Faculty of Arts at my university, a concern was raised that only a 'digital elite' were benefiting from a move towards integrated online teaching. Relatively few were obtaining funding for innovative projects and, increasingly, these few were distancing themselves from colleagues who had not yet begun to explore new modes of instructional delivery. Similar to Gunn, Lefoe, Graham, Left, and Smith (1999), we began to worry about our own 'digital divide' between those mastering the new technologies and the staff who had a limited understanding of the use of technology in teaching. An informal survey of the use of IT showed us that it largely consisted of motivated individuals working in isolation.

In response, the Faculty set out to encourage and fund *staff development* initiatives. In this paper, I trace how we identified key issues in staff IT training and put together a framework for integrated staff training. My paper concludes with reflection upon some of the persistent issues still facing the Arts.

Identification and Clarification of Key Issues

As Ellis, O'Reilley and Debreceny (1998) report, we found relatively few reports on academic staff development for teaching and learning online and/or technology training in the Australasian context. Before developing our own program, we used their study as a framework and set out to identify key themes in the area of staff development. Although we recognise that we run the risk of building upon a narrow foundation, we made the decision to constrain the variables which might influence the provision of staff training (e.g. the cultural context, workplace agreements, or funded staff development programs) by focusing primarily on papers presented at ASCILITE conferences from 1995-2000.

As we read, we brainstormed and rejected potential themes. Eventually, we came up with a tentative set of categories and then had colleagues check to see if our analysis had a degree of 'resonance' with their own experiences. After more debate, we arrived at five categories we thought might underpin the foundations of a staff development program (Table 1).

Central theme	**Key points**	**References**
Anxiety regarding the use of online technologies	Embarrassment of being perceived as technologically illiterate	Gunn et al (1999); Koppi, Chaloupka, Llewellyn, Cheney, Clark and Fenton-Kerr (1998) McNaught (1995); Salter & Hansen (1999)
Sceptical of online learning	Pre-disposition to certain styles of teaching Technology degrades rich face-to-face interactions IT 'privileged' for its own sake Gap between innovators and primary practitioners	Bennett et al (1999); Jones, Stewart and Power (1999); Hewson and Hughes (1998)
Lack of clear university policies	'Soft', intermittent funding Little recognition or time allowance for online teaching; few career incentives Tenure related to research, not innovative teaching practices	Gunn et al (1999); Jones et al (1999); Leigh (2000); Marriott (1997); McNaught (1995); Porter and Corderoy (1998) Rossiter (1997); Salter and Hansen (1999)
Absence of IT assistance; working in relative isolation	Academics not interested in mastering technologies, but how to use them Require ongoing team-based support to work with seemingly complex systems and applications	Corderoy and Lefoe (1997); Porter and Corderoy (1998); Salter and Hansen (1999)
Problems in developing online materials	Quality may not be of a global standard Unexpected copyright, access and format issues Under-estimated development times	Bennett et al (1999); Jones et al (1999); Pilgrim and Creek (1997); Cecez-Kecmanovic and Webb (1999)

Table 1: Selected staff development issues in ASCILITE conference papers (1995-2000)

The themes we drew from the literature certainly resonated with our experiences in the Arts Faculty. Regarding anxiety, it was clear from our discussions with colleagues that Arts staff often distanced themselves from technology. On occasion, being a 'Luddite' was worn as an honorary badge. It was a point of resistance against a perceived effort that IT practices sought increasingly to homogenize the curriculum.

In a Faculty that prides itself with small class sizes, a 'human touch' and heavy involvement with face-to-face teaching, the spread of IT technologies was met with a degree of scepticism. Few of us could even think of ways to make our reliance on the printed text come alive in ways that we had seen in Medicine or Science that brilliantly worked through complex processes in all kinds of visual ways. Increasingly, too, an undercurrent developed amongst staff who came to view IT as a 'privileged' way of teaching. No matter how good you were, it was felt, you would not be recognised without the integration of online materials into your subject.

As Ellis and Phelps (1999) recognise, for example, we also felt that academics require more than the development of technological skills. Online development necessitates new pedagogical approaches, challenging previous practices with regards assessment, group interaction and student/teacher dialogue. The progression towards on-line teaching and learning often necessitates collaborative teamwork in relation to course design, development and delivery. It was going to take a shift in culture across the Faculty to really make a difference.

Working in isolation is a constant bane of an Arts academic. More than professionally-oriented programs such as business studies, we do not necessarily share a 'common goal' or even generally recognised 'industry standards'. Although Cecez-Kecmanovic and Webb (1999) found that a collaborative model of staff development promoted a feeling of "mutual support that staff gained, knowing that others were facing, and together solving, the challenges of this new teaching environment" (p. 57), Arts staff are accustomed to working alone and getting sole recognition for their work.

Perhaps tied to each and every one of the issues we found was simply the fact that the development of decent IT materials takes time. For those who had gotten funding, we watched in dismay as they came to grips with complex technical and pedagogical issues when they attempted to put materials online.

Towards a Faculty of Arts Staff Development Plan

Near the end of 1999, an internal survey of academic staff showed that 52% were interested in developing their skills in the use of IT&MM. Based on this interest, the Faculty decided to provide 30% of its IT funding towards staff development projects to meet four central goals:

- To create a culture of learning with technology in the Faculty;
- To create an atmosphere of collaboration and sharing of innovative practices;
- To create a climate of reflection on teaching practice;
- To raise to 50% the number of academic staff "trained" in IT&MM.

For definition, we decided that those who completed funded projects, or participated in at least eight hours of workshops would be considered "trained".

Nine of the Arts projects funded in the academic year 2000 included a specific staff development component. The response was enthusiastic, and attendance records indicated that 140 staff participated in a development activity. To evaluate the efficacy, the Faculty Associate Dean, IT in the Faculty commissioned an external evaluation of the program. Two evaluators from the Centre for the Study of Higher Education completed the study in February, 2001 (MacKinnon & Hartley, 2001).

MacKinnon and Hartley (2001) conducted semi-structured interviews with 8 of the 9 grant holders and e-mailed a short questionnaire to 46 of the workshop participants. Twelve (26%) of the participants responded. Overall, the evaluators found that the staff development program was received very well and found that a "profound and enduring shift has taken place within the Faculty of Arts with regard to the acceptance of technology and teaching" (p. 1). Despite this clear success, the researchers also discovered three key concerns that staff raised about the program.

First, MacKinnon and Hartley (2001) found that staff questioned why the provision of workshops was based on 'soft', rather than ongoing, sources of funding. They argued that it would be more appropriate to have such programs on a regular basis. Related to this, staff also reported a preference for departmental-based sessions over cross-faculty workshops. Within departments, the academics thought they could better build opportunities for collaboration and collegial assistance.

A second concern regarded the threshold of staff training. How many skills was an average academic expected to gain in regards to IT&MM? Already pressed for time, they preferred more technical support and expertise be made available so as to free them up for the use, and not the production, of online teaching materials.

Finally, staff noted a gap between learning about IT&MM and actually using it effectively in their teaching. That is, they wanted to de-emphasise technology for its own sake and gain more of a focus on teaching with IT&MM resources. Staff also asked that training take place during non-instructional periods, include an individual tutorial component and form part of a wider conversation across the Faculty about sharing ideas and experiences.

Moving in New Directions

The current dispersed approach to academic professional development has in many instances resulted in blurred boundaries and a sometimes unnatural divorcing of theory from skills. We started discussion by making a list of contrasting ideas (Table 2).

Individual training sessions	Collaborative training sessions
University-based	Faculty / departmental based
Dispersed training staff	Integrated, one-stop services
Lack of recognition	Career incentives
Modular	Integrated
Skills and technical focus	Theory and pedagogical focus
Grass roots	Policy driven
Institutional-based	Needs based
Deficit model (don't have)	Additive model (will enhance)
Occasional sessions	Intensive programs
IT privileged	Best practice privileged
University conference on IT	Innovations in teaching and learning
Staff only	Student involvement

Table 2: Blurred boundaries and possible directions in staff training

This set of 'simple binaries' served as a useful way to initiate discussions with staff trainers both within and outside the Faculty. Rather than present a list of (sometimes) competing ideas and services, the table provided us with a way to begin thinking about how to move forward. That is, the table acted as a catalyst for discussion in a context where there are relatively few defined boundaries.

An Integrated Framework for Staff Development

The Faculty responded to the external evaluation and the demand for staff development activities by once again highlighting the need for staff development in IT&MM project funding, re-focusing goals in this area and appointing a lecturer to co-ordinate staff development activities.

In light of the report, we argued for a holistic approach to academic staff development. Such a program would attempt to bring together providers across the University in an effort to provide academics with clear and structured pathways to professional development.

A United Approach

The staff development coordinator drew together workshop ideas, personnel and funding from a variety of sources: the Arts IT&MM Committee, the Faculty of Arts technical support unit (ArtsIT), the Centre for Communication Skills and ESL, the Disability Liaison Unit, the Horwood Language Centre and the Department of Teaching and Learning Resources, Information Division. We set out to develop a single 'shop front' that would bring together information relating to all the providers and their contacts in regards to current events, documentation, templates and support material.

When we built a website to advertise ourselves, we included an online registration facility for all workshops. Relevant providers were listed in a central database and academics seeking assistance were directed to the most appropriate provider(s). In consultation with providers, we update the site on a regular basis and encourage it to be linked from Faculty and departmental web pages.

Staff Development Teams

We decided to create staff development teams to provide Departments with consulting. In this instance, we borrowed ideas that Radloff (Online) suggested for helping implement staff development. Team members, Radloff urged, should liase directly at the departmental level. The role is that of a *case manager,* who facilitates, coordinates and organises professional development specific to departmental and individuals teaching and research needs.

In collaboration with specific Departments, our team members complement and extend existing programs. In a sense, we help to translate identified gaps into programs that integrate theory and skills. After this stage, we then try to bring together resources from providers across the campus to create tailored and flexible programs. Where one-to-one training is needed, consultants do this themselves or contact other team members appropriate to the task.

As programs are completed, the consultant continues to maintain an ongoing role with departments and individuals. The team member assists with evaluating programs, working with individuals, identifying further needs and encouraging participation in programs.

Departmental Point of Contact

At present, members of training units have a difficult time promoting their services simply because there is no identified 'point of contact' at the departmental level. To facilitate professional development, we utilise contacts within the IT&MM Committee to act as liaisons between a training consultant and the representative Department. Essentially, they work with the consultant to conduct a needs evaluation and develop a strategic approach to professional development. After the development of guidelines to define roles and directions, a Faculty-based orientation for all contacts could be run as a point of departure.

Relevant, Focused Workshops

With the team in place, we sat down and brainstormed what academic staff had best responded to previous offering we had each made as individual trainers. We departed from what we had in place, and then tailored our own work to what could be accomplished within a two-hour sessions. Some of our thinking had to be re-directed away from what we had learned during our experiences as undergraduate instructors; at other times, we had to think beyond our own embedded work practices to get back to basics. Eventually, we came up with a menu of 14 different modules that ranged from introducing the use of web-based University services to designing for disabilities through to discussion on teaching with the online class management facility. One-to-one tutorial sessions were offered and regularly scheduled throughout the two-week program.

Ongoing Seminars

During the semester teaching period, we switch our emphasis on staff development away from technical skill building to discussions regarding pedagogical issues. As Salter and Hansen (1999) remind us, of course, there's no unified set of skills and strategies required for on-line teaching and so we look at 'case studies' of using IT in different contexts. We have both internal and external guest speakers. In conjunction with this series, we continue to work with academics on a one-to-one basis throughout the semester.

The Arts IT&MM Fair

For the last two years, and then this one, the Associate Dean, IT has organised a half-day 'fair' during the non-teaching period to showcase IT&MM projects throughout the Faculty. The atmosphere is light-hearted and collegial; last year, for example, bottles of champagne were given as door prizes and two poets helped open the proceedings. Over the course of a morning, attendees are invited to walk around and visit presenting academics in one of three balloon-filled computer labs. The emphasis in these fairs is on informal conversations, the sharing of practical advice and, to be honest, a way to show each other simply what we've all been doing. The value in such activities lies in breaking down barriers between the somewhat more formal University-wide internal conferences in online teaching and visits to individual classrooms and offices. In the future, we plan to encourage students to present their thoughts and work about online learning alongside ours at the fair.

Persistent Problems and Challenges

One central theme of this conference is reflection. Speaking for ourselves, we would be naïve to think that we couldn't do better in terms of inter-team coordination, workshop scheduling, offering incentives for staff and our own motivation.

Lapses in Communication between Providers

Despite our best efforts and mutual goodwill, our somewhat loose coalition of training partners falls apart on occasion. We simply do not see each other that often, nor do we share a clearly defined agenda for staff training. What is originally scheduled to be a planning session for workshop may turn into a heated discussion about pedagogical approaches, for example, or tensions may develop amongst team members in regards to the sharing of materials. To address these issues, we're trying to make time to get to know each other through relaxed lunches as well as better define our own roles in the larger group. We find that fractured and busy schedules defeat our efforts to meet more often. Perhaps we could make better use of IT resources such as bulletin boards, group websites and online discussion lists to foster better communication amongst ourselves?

Scheduling of Workshops

When is the best time to train academic staff? During the semester, most are so focused on their present teaching load that they simply can't spare an afternoon to consider other modes of delivery. In non-teaching periods, staff are hesitant to devote precious research time to attend workshop sessions. What we've done so far is to schedule longer sessions during the non-instructional periods, maximise the flexibility of our offerings through multiple presentations and maintain a bi-weekly staff training afternoon during the semesters. Nonetheless, it seems, we never seem to get it right – and sections of the Faculty inevitably miss out.

Incentives

Increasingly, we are moving towards offering financial incentives for staff to attend training sessions. There's been debate amongst us whether paying salaried staff is the best way to spend our limited IT&MM funds, but it seems that some recognition of their efforts is needed to bolster workshop attendance. Especially as we move beyond the enthusiasm for IT that was evident in groups of early adopters, it is a challenge to encourage already busy staff to further develop their skill set. If funding attendance doesn't work, we may be at a loss for ideas: as a general rule, we are hesitant to move towards any punitive or coercive 'incentives' for training.

Staying on Track and Staying Motivated

To be frank, our motivation has been derailed recently by our somewhat belated understanding of accessibility (Nevile, 1999) and legal issues (Lean, 1999). The challenges of meeting digital copyright and accessibility laws in addition to both Faculty and University web publishing guidelines is seemingly overwhelming. By the time those of us in charge of leading staff training understand the many aspects of putting up a fully compliant teaching web site, for example, the terrain seems to shift. That movement, of course, frustrates our efforts to act as 'friendly translators' to other staff members who are just coming to terms with online teaching. In regards to digital copyright laws, for example, the realisation by some staff that individuals are now personally liable for infringement has cooled their drive to learn to post materials. To meet accessibility regulations, we have first had to ask external consultants to train a small group of web designers, and then determine how to make that information and training available to a wider group of staff members. Such efforts have left our team dispirited at times.

Conclusion

We've made a start, and have begun to address some of the key issues in staff development that are facing Australian tertiary educators across the board. To be honest, it's been difficult to stay on track with the five areas we identified: the anxieties, the scepticism, unclear policies, working in isolation or difficulties in creating online materials. What we thought would become a strong framework for a training program has essentially been turned into our own set of briefing notes.

We regard our key success so far to be the promotion of a supportive culture for IT teaching and learning within the Faculty. At the end of this academic year, we will again commission two more external reviews to see how we've done. One review team will evaluate of our current staff development program; the second report will try to determine if the students themselves see any of the results of our efforts.

Of course, we recognise that staff development must eventually be held in accredited training courses to reflect a growing need for formal recognition (Ellis et al, 1998). We need to investigate staff training in more depth and follow up on the work, for example, of O'Reilly, Ellis and Newton (2000). Further, it is no secret that we ourselves are still working out how to be trainers, and how to integrate the traditional academic career with those of an emerging hybrid breed of academics who are colleagues, trainers and recognised researchers in their own right.

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EFFECTIVE ONLINE TEACHING – HOW FAR DO THE FRAMEWORKS GO?

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Abstract

As online learning becomes a mainstream phenomenon in courses with face to face components as well as those conducted at a distance, a number of frameworks have emerged to describe the role and attributes of the effective online teacher. Effective teaching and course management skills for rapidly changing environments are one aspect of the requirements. Online teachers must also be recognized, to some extent, as agents of change within their own institutions. This is particularly true in respect of the ability to develop the receptive cultures and communities of learning that have proved prerequisite to success in online learning environments. This paper examines some recently developed frameworks for effective online teaching and relates these to published case studies describing a range of courses and situations. The conclusion is that current frameworks provide a general though high level description of what is involved in effective online teaching. As such, they provide a useful starting point for further analysis of the issues that determine the quality of online courses and teaching. This in depth analysis of teaching and learning issues will provide the basis of guidelines for best practice. It is further noted that frameworks for effective institutional support are equally instrumental in successful implementation.

Keywords

online teaching, educational models, instructional design, computer mediated communication

Introduction

Development of various forms of online courses and activities has brought the higher education community to a point where attributes and criteria for effective online teaching can be formally and reliably identified. A number of frameworks describing the roles and attributes of effective online teachers can now be found in the literature. This paper draws on publications from a small but representative sample of eminent authors as the basis for analysis and discussion.

Existing Frameworks

Using a learning model as the focal point for defining teaching requirements, the analysis begins with a description of various stages that online learners must progress through. Salmon's Five Stage Model of Online Teaching and Learning is based on the medium of computer mediated communication (CMC), (Salmon, 2000). It is a consolidated model derived from an action research process and is described together with student actions and responsibilities in Table 1.

Stage	Activities
1. Access and motivation	Individual access and motivation to use CMC, set up and development of skills to use technology tools, formation of expectations of CMC
2. Online socialization	Establishment of online identity and a basis for interaction with others, fluency in use of tools and development of online culture.
3. Information exchange	Exchange of course related information, development of strategies for dealing with quality, volume and frequency of communication, setting orientation to task.
4. Knowledge construction	Course related group discussions, interactions and collaboration, establishment of common understandings, exposure to multiple perspectives and development of personal meaning.
5. Development	Achievement of personal goals through interaction with the established system of communications, integration of CMC with other forms of learning, reflection on the learning process, development of autonomy and removal of scaffolding.

Table 1: Five stage model of online teaching and learning

Another framework published by Collis (1996) defines six vital instructional principles for adult education. These principles are entirely consistent with Salmon's (2000) model although framed in terms of the teaching learning process and characteristics of learning environments:

- Both the learner and the educator play an active and unique role in the educational process.
- The process of creatively acquiring knowledge involves human interaction and learner competence that are developed and evaluated within a communication oriented educational model.
- Contemporary models of learning support learner-centred instruction that encourages self-assessment, personal reflection and elicits learner articulation of their ideas.
- The learning environment should maximize meaningful and reflective interactions while providing a variety of opportunities for feedback.
- Creating instruction that promotes learner self-regulation and individual responsibility is the product of educators who are academically well prepared and monitor the quality of student work.
- Adult educators recognize that students want to move efficiently through their studies in both time and energy; students do not automatically have good study skills, discipline or motivation.

In order to support the various stages of learning design, process and assessment defined in these frameworks, Salmon (2000) identifies the following competencies for online teachers:

Understanding of the online process;
Technical skills;
Online communication and moderation skills;
Content expertise;
Confidence and motivation to teach online.

Different aspects of these competencies are described under the dimensions of confidence, constructivist, developmental, facilitation, knowledge sharing and creative elements. Following publication of this work, the author participated in an international workshop, the product of which was a consolidated framework summarizing competencies for online teachers (Goodyear, Salmon, Spector, Steeples & Tickner, 2001) as shown in Figure 1.

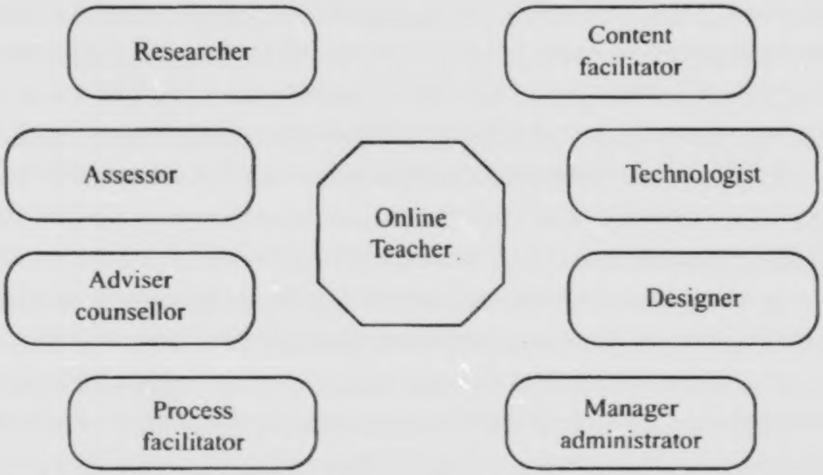

Figure 1: Roles of online teachers

A review of some case studies is now presented to illustrate how these principles apply in practical situations. Many of these studies are drawn from an international online tutoring workshop that was hosted by a Scottish Universities consortium during 2000 (online). Others are gleaned from the current literature.

Experiences Described – The Online Workshop

A summary of principles derived from case studies presented during the online workshop follows. One case described a course designed for teaching staff to learn through experience what the active and unique roles of teachers and students identified by Collis (1996) in the online educational process mean in practice. The objective of training effective online teachers was articulated by first exposing the trainees to models of effective tutor behavior from the student perspective. This experiential approach is increasingly common and has proved to be highly effective in a range of different settings. In this case, the human interaction process was kick-started by posting of personal introductions and continued through on-line discussion of course related topics. Initial orientation in the use of online study habits was followed by timely feedback and support provided by the teacher. Collaborative learning was promoted through team assignments where knowledge acquisition formed part of the group task. Elements of problem solving completed the educational design and the asynchronous medium allowed time for reflection before submission of work to members of the study group or to the tutor. Apart from an almost textbook example of application of Collis' (1996) model, the main principle highlighted in this study was having a well qualified and enthusiastic teacher actively involved in the process, available for all support needs and to overcome technical or psychological barriers to success. Although the Goodyear et al. (2001) model addresses all the functional aspects, enthusiasm is a critical attribute that is not specifically identified.

A similar case described a "New Technology of Learning" masters level module, where the convenience of access for students with work and family commitments provided the rationale for on-line study. This type of access opportunity is recognized as providing a strong incentive for students to learn new skills and to cope with an unfamiliar and sometimes frustrating study environment. The essential skills identified for teachers on this course also conform to the models, i.e.:

- Enough technical skills to manage the platform, to use the tools effectively and to help students develop appropriate study skills for the on-line environment;
- Good moderation skills for on-line discussion and the ability to make timely, appropriate and constructive interventions;
- Motivation to engage in ongoing professional development to keep abreast of new developments.

Another case emphasized the educational aspects by stressing the need for tutors with the ability to define and apply established pedagogical principles and to embellish these with suitable technology tools. It was also considered important to provide adequate materials and options to accommodate different learning styles.

A case presented by Gilly Salmon, author of the main framework examined in this paper, also related to experiential training of tutors for on-line courses. Key aspects of the work presented as a case study are elaborated and generalized in the book "E-Moderating, The Key to Teaching and learning Online", (Salmon, 2000), and Collis' (1996) six principles are reflected in this work. The significant roles and responsibilities of online teachers were defined as follows:

- Helping students to set clear expectations and goals, guiding active and experiential learning in a flexible learning environment so students can choose to follow preferred paths without risking losing track;
- Applying constructivist principles through interaction with fellow tutors, moderators and software tools;
- Helping students to build both knowledge and software skills in a supported environment;
- Ability to use familiar metaphors to explain unfamiliar processes and tools;
- Ability to strike the right balance between self managed learning and the need for intervention and support, i.e. to provide scaffolding;
- Knowledge of strategies to promote reflection and interaction.

A Review of Online Teaching Frameworks in Use

It may be concluded that the case study experiences in the online workshop correspond well with the published frameworks. However, it is clear from the following literature based examples that greater depth of definition of the skill set for online teaching is required. To be fair, frameworks are designed to be general and high level, not to address implementation details or the specifics of individual cases. However, the need to derive grounded theory for effective online teaching cannot be served by frameworks until more detailed definitions of the elements are produced. Analysis of framework elements in the context of cases studies now follows.

Knowledge of the Online Process

Gunn and Barnett (2000) present a case study describing one early adopter's relative success in online teaching. A course in "Information Technology and Education" based on active, experiential learning principles offers significant opportunities for students to pursue their own professional interests within the structure of the learning environment. The design reflects Herrington and Oliver's (2000) criteria for authentic learning environments. The course content is generated and discussed collaboratively. Major assignments can be tailored to reflect individual interests. An additional element of the assessment is formative and computer based. The experience of the teacher in pedagogy, understanding of the online process and effective use of technology for learning complies with the attributes identified in the frameworks.

Two major challenges addressed in this case were the risk that online learning can be depersonalized and that it can lack sufficient interaction between students, their peers and lecturing staff if appropriate strategies are not used. Secondary considerations afforded recognition to the fact that computer mediated communication tools offer great potential to overcome distance and increase flexibility in terms of time and place, but their use within a course does not guarantee that any such benefits will be achieved. Summative evaluation findings showed that many benefits were achieved in this case because the technology tools were used to support instructional strategies appropriate to the level and capabilities of the students. They actively promoted acquisition and practice of the skills defined as the learning outcomes and applied a philosophy of learning that was entirely reflective of the course objectives. It may be argued that this approach would have lead to successful outcomes regardless of the tools or technology used. The challenge was to use unfamiliar and largely unproven tools and methods of flexible learning to create a culture and community of learning that required a high degree of interaction and personalization to achieve the objectives.

A less positive outcome of this study demonstrates that application of all the accepted principles does not necessarily lead to successful outcomes in every respect. Because the course required a high level of personal interaction, it was time consuming for students and labour intensive for teaching staff. It was (reluctantly) concluded that the level of interaction could not be managed with large numbers of students without strategies to devolve some responsibility from the lecturer to autonomous groups of students. Different options are now being tested, although current thinking is that it may compromise one principle of effective online learning, specifically, that of providing models of expert behavior for learners to follow. If there is no way to keep student to staff ratios low, and a high level of interaction is required, the challenge of designing effective online strategies will be significant. The main conclusion about the frameworks drawn from this case is the simple fact that their application may prove to be unsustainable for practical reasons. The overall impact of situational factors is discussed in a later section of this paper.

Technical Skills for Online Teaching

Benseman (2000) defines the technical skills required as similar to those identified in the frameworks, and proposes that many of the lessons learned with old technology still apply. Bates (1995) warns that better technology does not necessarily mean better education and Benseman further observes that the technology used in most educational settings is not leading edge, although it is advancing and student skill requirements increase accordingly. Thus the requirement for tutors to be familiar with technology extends from the existing and available to newly emerging technologies so they can assist students with development of appropriate skills in the use of tools as they come into common use. By way of illustration, Benseman (2000) reported that in 1995 more than half the students in one project had never or occasionally sent file attachments. Now this is a common action that all basic users are familiar with. The teacher's skill is not just to support students in development of new technology skills, it is also in knowing when they can be prompted to move on to a new level, such as requiring internet access as pre-requisite to entry on a course. This brings up the need for institutional readiness, as discussed below, so facilities and support can be put into place to make such expectations realistic. Many universities now distribute CDs with basic software such as a current version of a browser, email program, acrobat reader, site licensed office products etc. to address technical requirements.

As well as issues of technical readiness, Benseman (2000) identifies cultural and conceptual shifts associated with online learning. This reflects the need for teachers to be agents of change, to motivate students to use new tools and methods, to help build confidence and understanding of both potential and limitations, and to overcome fears about technology and the unfamiliarly high level of visibility of individual contributions.

Online Communication and Moderation Skills

The statement in Salmon's framework that effective teachers require "online communication and moderation skills" offers a very high level description of a complex requirement. In addition to gender differences in communication style identified in the literature, (Herring 1996; Richardson & French 2000; Yates 2001) there are many levels and types of discussion defined in the educational literature. Some predate online learning, (Pask, 1976; Collis, 1991) while recent work has that specific focus, (Reibel 1994; Newman, Webb & Cochrane, 1995; Brown 1997; Quinn, 1997; Hara, Bonk & Angeli, 2000).

Richardson and Turner (2001) evaluated the use of virtual learning environments and developed guidelines for discussion moderators based on the experience. Their paper reports on the interactive systems that provide students with the opportunity to communicate and discuss their courses asynchronously. The obvious differences in virtual communication, i.e. the lack of visual, aural and kinesthetic cues are acknowledged. The absence of socio-linguistic conventions to guide the initiation, development and closure of discussions was also identified. The area was clearly an uncharted one that caused frustration and isolation among students. Effective communication did not happen because of the students' unfamiliarity with the process and the absence of "signposts" for conducting online discussion. The following guidelines were developed to address these problems:

- Tutors clearly state the purpose of the discussion with learning outcomes and individual benefits in mind;
- Initial raising of metacognitive awareness to help clarify expectations;
- Negotiation of ground rules to clarify expectations and define acceptable behavior;
- Formal and informal links between discussion and assessment are made clear to students;
- Guidelines on number, length and assessment criteria for contributions are provided;
- Tutors initiate discussions and students contribute according to agreed criteria;
- Tutors model facilitation of online discussion until students are confident enough to proceed independently;
- Students communicate with tutors and suggest appropriate topics for discussion;
- Tutor acts as moderator;
- Tutor continuously evaluates and gives constructive feedback on academic merit of student contributions;
- New topics outside the main theme are taken to separate discussion areas;
- Tutor advises students about time of presence in online discussion areas;
- Time frame for discussions and boundaries are set;
- Feedback to all participants follows closure of discussion.

At a deeper level of analysis, Sherry, Billig and Tavalin (2000) deconstruct dialogue and conversation as an educational tool, and in doing so, underline the need for online teachers to understand and develop the ability to lead different types of discussion for course related purposes. The requirement is for teachers not just to be able to moderate discussions but to understand the educational merits of different types of conversation and different levels of learner contribution as learning proceeds. The stages of learning identified by these authors are comparable to Perry's (1970) levels of maturity in learning and reflect similar types of understanding, that is, dualistic, early and late multiplistic and contextual relativism. Progression through these stages is described by Sherry as "The learning curve for technology based conversation". Against this background, the task of initiating and moderating online discussions involves significantly more than developing conventions, applying rules of netiquette and keeping students on task. The underlying knowledge of educational levels, ability to link learning activities to specific outcomes and subject areas, and progression from lower to higher levels of thinking is also assumed. An example cited by Sherry of the means to promote higher learning is "conversation" within a Rich Environment for Active Learning, (REAL), (Grabinger & Dunlap, 1995). The definition of REALs illustrates that they are based on constructivist values and theories, include collaboration, personal autonomy, active engagement, personal relevance and pluralism.

Content Expertise

In a general discussion of the skills of effective teachers (Barnett & Hodson, 2000) identify content knowledge as just one of five dimensions of the required expertise. The definition includes academic and research knowledge, professional knowledge, classroom knowledge and pedagogical content knowledge. In summary, this requires application of academic knowledge to build research-based knowledge of course related topics. Professional knowledge ensures courses fit well with university and departmental regulations. Classroom knowledge relates to awareness of the characteristics of a new teaching and learning environment and pedagogical content knowledge is required to define the best ways to teach content in a given environment. The basis of this definition is both contemporary and constructivist (Honebein, Duffy & Fishman, 1993; Reibel, 1994; Grabinger & Dunlap, 1995), yet rooted in longstanding traditions of liberal education. Despite the current evolutionary nature of the technology in focus, the underlying educational theory has been developing for nearly half a century. Principles such as going "beyond the information given" (Bruner, 1957), and the use of argument and reasoning (Toulmin, 1958; Toulmin, Rieke & Janik, 1984), remain significant to the achievement of objectives and the design of learning activities while the ability of new media enhances opportunities to achieve these ends. The issue of content expertise is thus more complex than the framework implies.

Confidence and Motivation to Teach Online

A review of current practice shows that effective online teaching practice may not be implemented despite the existence of policies, quality assurance standards and guidelines for effective practice. Potential obstacles include low motivation and lack of confidence. This reflects the situation in the 1990s where new education technologies were available and proving successful in some cases, but not entering mainstream teaching practice (Darby, 1992). The motivation behind moves to online learning can bring a significant influence to bear on both the effectiveness of the approach adopted by teaching staff and the learning design and outcomes that will result. Jaffe (1998) proposes that high success rates resulting from efforts of early adopters may be attributed to the fact that they opted for innovation as a means to improve their teaching and the learning of their students. In many cases there were significant obstacles to overcome, i.e. low institutional support, policies that reflect traditional teaching situations and lack incentives and rewards for innovators. Jaffe (1998) also suggests it is probably no coincidence that many early adopters were already excellent teachers in traditional mode. The rise up a learning curve with new technology and educational methods was therefore not motivated simply by a need to comply with institutional strategic objectives. The fact that online learning has become 'flavour of the month', is now the key to unlock sources of funding and increasingly, to gain academic recognition, has considerably increased the range of motives behind developments.

It may be argued that motives behind a move online have little direct impact on effectiveness of online teaching. However, it may also be argued that motivation is an important element of effectiveness in most learning situations so would certainly impact on Salmon's (2000) fifth dimension of confidence and motivation to teach online.

Contextual Influences on Success of Online Learning

Jaffe (1998) reminds us of the reality of higher education as a social institution, which means that organizations are not rational, adaptive entities that respond logically to demands placed on them by the rapidly changing environment. Forces that spell radical change to professional identity and practice and the accompanying loss of security may be met with a range of resistance strategies. The shift to online learning is variously regarded as a promise, a threat, irrelevant to some disciplines and unnecessarily time consuming. Any of these conceptions is unlikely to lead to easy adoption of effective online learning strategies. It is usually where systematic change management, development and support strategies are adopted that take up rates are high across the board. From a holistic viewpoint, the phenomenon of online learning cannot be separated from the situation it exists within. In addition to criteria for effective online teaching therefore, an institutional support model for flexible learning, such as that presented by The US Institute for Higher Education Policy (2000) is required to create conditions that support such developments. A list of twenty-four benchmarks covers:

- Institutional support;
- Course development;
- Teaching and learning issues;
- Course structure;
- Student support;
- Staff support;
- Evaluation and assessment.

The objective of such comprehensive approaches is recognition that online learning is well placed to address pedagogical and logistical issues in a changing environment. For institutions the realization must be that online learning is a legitimate development, though one for which staff and students need intensive support, retraining and the right to define the boundaries. Finally, they must accept that increased profitability is not the most appropriate driving force behind developments (Bates, 2000).

Conclusions

A list of attributes and behaviors of effective on-line teachers distilled from the literature and case studies cited includes the following:

- Give on-line learning a human face, for example, by having an initial face to face meeting or introductions from all students;
- Help to clarify roles and responsibilities, time management techniques and expectations, i.e. provide a structure and boundaries for students to work within;
- Facilitate, moderate, motivate and promote participation;
- Demonstrate good practice, be explicit about what is good and what is excellent performance;
- Use strategies designed to include all students;
- Respond in a timely manner and give appropriate (constructive) feedback;
- Promote and assist with development of adequate technical skills to use a platform or tools;
- Base courses on the articulation of sound pedagogy and assessment practice;
- Provide adequate materials and activities to accommodate all learning styles;
- Promote and encourage self-management and responsibility;
- Evaluate, review and modify teaching practice according to feedback;
- Engage in professional development to keep up with innovations.

The developmental nature of online learning suggests that this list of attributes is not static, but will be continuously updated to reflect the appearance of new tools and techniques and the evolution of associated learning issues. This author concludes that frameworks must be accompanied by in depth analysis of attributes of effective online teachers. As well as the high level descriptions provided in the current literature, further exploration of the attributes of online teaching is required, i.e:

- Characteristics of different types and levels of educational conversation;
- Development and assessment of learning activities that promote the articulation of reasoning, knowledge and problem solving processes, where multiple perspectives are generated and respected;
- Development of strategies to resolve conflicting viewpoints and promote reflection on process and outcomes;
- Skillful prompting, refocusing and moderation;
- Provision of constructive critiques, feedback and supportive interjections to signpost and direct learning;
- Use of strategies to expand a body of knowledge and to transform thinking and personal perspectives.

The impact of contextual factors must also be built in to the frameworks if they are to be used as guidelines for implementation and criteria for evaluation. Finally, the implications for professional development must be articulated and best practice defined in this respect. Much attention is currently being paid to this area, (Creanor & Littlejohn, 2000; Herrington & Oliver, 2001). Since the bulk of research and evaluation in these areas is necessarily based on case study research, the process of generalization will be slow. The range of influential factors briefly described in this paper demonstrates that elaboration of the framework elements is already a complex task, and there can be little doubt that other factors will emerge as influential during the process of analysis. Issues such as gender and identity are already being researched. The longer term impact of a shift towards student centred and constructivist principles and the rapid emergence of faster, cheaper and more accessible technologies are two areas rife with speculation.

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THE GRADUATE DIPLOMA IN EDUCATION TECHNOLOGY: THE DEVELOPMENT OF AN ONLINE PROGRAMME

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Abstract

The Graduate Diploma in Education Technology (GDipEdTech) was developed in 1993 as an open and distance programme to meet the needs of teachers in the primary, secondary and tertiary sectors. The programme aims to integrate the use of new and emerging technologies into their classroom programmes. It has gone through a number of developments in order to keep pace with changing technologies. From being a largely print-based programme, augmented by First Class communication software, it has moved to one that has been fully operational online since 1997. It was first developed using HTML. At the end of 1999 the programme was transferred into a commercial online course shell, Blackboard. This development has meant a challenge for the Programme Leader and lecturers to present a programme that takes account of contemporary learning theories, adapting them to an online learning environment. They must keep abreast of parallel developments in both web-based technologies and online teaching techniques.

Keywords

Blackboard, education technology, online learning, schools, professional development, web course tools

Introduction

The Graduate Diploma in Education Technology was developed in 1993 as a two year part time, open and distance programme designed for teachers at primary, secondary and tertiary level. The programme aims to develop and encourage the use of new and emerging technologies in the provision of student-centred learning. The programme comprises seven courses covering the areas of learning theory, instructional design, ethics, equity, role of the teacher, applications, multimedia, telecommunications and managing education technology. The way in which the programme is taught is designed to model good teaching practice using a range of technologies. The challenge for the Programme Leader has been to offer an innovative professional development programme for teachers that takes account of contemporary learning theories, uses new technologies and sound online teaching techniques. Strategies to develop effective online learners have also been incorporated into the programme. This paper describes the development process that the programme has undergone from its first days using a communication package to augment print-based material, to a fully online programme using web-based course tool software.

Online Learning

In considering current learning theories, St George (1997) advocates that effective learners are motivated, knowledgeable, strategic, reflective and socially interactive. Interactivity on the internet is one way of promoting active learners. Learning activities are devised in such a way as to encourage and to expect learners to interact with a) the course material, b) the lecturer and c) other participants, in order to process and reflect on the information in order to create new knowledge. Crook (1996) argues that the process of social interaction is very important in order to support cognitive change. The inclusion of metacognitive activities is essential to enable learners to reflect on their own practice and to assist in the transfer process, to relate new knowledge to their own situation. Lock (1996) describes how humans are at a stage where we can use new forms of telecommunications, especially the internet, to create new forms of community with the new technologies mediating our activities. Hence, this new technology to mediate the process of learning. The computer as a means of communication is the actual mediator. The learner is empowered to think effectively in new situations.

When developing an online course for teachers one must be aware of the needs of teachers as adult learners. For teachers to participate in professional development programmes successfully, whether face-to-face, or online, several conditions must be present. These include: the establishment of a learning community (Pallof & Pratt, 1999), the recognition of the teacher as a person (Fullan, 1991; Joyce & Showers, 1995), the use of collaborative strategies where teachers can learn, work and share together (Brody & Davidson, 1998), the active involvement of school managers (Leithwood, 1992), and the time and opportunity to practise, discuss, reflect, support and challenge each other (Brody & Davidson, 1998).

The challenge is to provide a tertiary programme that helps teachers learn **about** the technology by **using** it to learn, in an authentic context. In other words they learn to use the technology by using technology to learn. At the same time, the programme models activities that they can transfer to their own classroom situation.

How can an online course be designed that encourages effective learners and meets the needs of teachers? A number of tertiary courses are already available online in New Zealand (Campbell, 1997; Halliday, 1997; Lai, 1997) which focus on teacher development in education or information technology. Campbell (1997) discusses changes in distance education that have come about as result of the move to using the internet as a learning medium. She highlights the need for such courses to focus on learners, to use the technology to develop effective social groups and to give learners autonomy and control. Lai (1997) uses the familiar environment of the classroom in a campus setting as a metaphor for his course web page design by including terms such as Libraries, Filing Cabinets and Notice Boards. Lai (1999) highlights issues such as interactivity, collaboration and social and interpersonal interaction to be considered when designing learning activities to scaffold and extend student learning. Hirumi and Bermudez (1996) discuss the importance of using strategies that promote interactivity, active learning and the development of learning communities as part of a successful online course. Ensuring that communication is human to human rather than human to computer is also an important point to consider. With these ideas in mind the Graduate Diploma in Education Technology was, and continues to be, developed.

Development of the Graduate Diploma in Education Technology

Phase One: The Print Stage

The course was first presented to students in a traditional print-based folder with learning activities included. Students came into UNITEC for an orientation day and three study blocks in each year. Each study block is of two or three day duration. This face-to-face pattern has remained throughout the development of the programme. To facilitate communication with students and also to provide a model of how the technology could be used for learning, *First Class* was used on a server - client basis. Client software was installed on students' home computers. There were some technical issues related to this. Students needed a relatively high level of technical skill to complete the installation especially if any compatibility issues arose with software already on their computers. Students were encouraged to log on at least twice a week. Two telephone lines at UNITEC were dedicated to this use. Email was one of the most successful functions provided, as 1994 was a time when personal email accounts were rare. Students *First Class* provided an exciting new way for lecturer and students to communicate. Electronic folders were created with information from education technology bulletin boards. Students were encouraged to post questions and share ideas. A chat facility operated but because only two people could log on at any one time, these were restricted to chats between two people so it was difficult to encourage group work. The course materials and activities continued to be accessed via the print-based folder.

Students were given a floppy disk with all necessary files for each course. These files were also included on the *First Class* server. Learning activities were integrated into the course materials at appropriate places. These included manipulating data on a spreadsheet and database to investigate relationships between ideas or issues to gain an understanding of how cognitive processes in learners could be incrementally increased by the way the teacher formulated questions.

As an example of how learning activities developed along with the programme I will describe one assignment that is the first that students undertake on entering the programme. The assignment requires students to understand the issues of ethics and equity in relation to the use of new technologies in education. In this first phase students investigated these issues in their own organisation and wrote an 800 word report for their Board of Trustees or governing body.

Phase Two: Web-based Learning using HTML

At the end of 1996 it became clear that the internet was going to have a major role to play in education. Developments in web technology were rapid, connections were more reliable and access faster. Many schools were gaining internet access. Because of the nature of the GDipEdTech, it was decided to adapt one course for the web. At this time there was very little collective experience of online learning. Campbell (1997) and Lai (1997), mentioned earlier, were developing their courses at the same time. Consequently the Programme Leader used her skill and knowledge of the learning process, built up over almost thirty years in the primary, secondary and tertiary areas, as a basis for developing educationally sound online learning experiences for teachers.

A creative, supportive and understanding web technician is essential when designing educational learning activities: one who can pick up, and elaborate on educational ideas and understand the nature of the interactivity that the lecturer is proposing. The demands of the learning situation must drive the use of the technology, not the other way round. UNITEC was fortunate in having such a technician. He said "don't ask if something is possible or not, tell me what it is that you want to do and I will figure out a way to do it." He often posed as the 'inarticulate student' and challenged the writer to clarify or justify reasons for wanting something done in a particular way.

The course was written using HTML and perl scripting. Activities that were already built in to the course were adapted for the web. Icons were designed to represent different types of activities. These included computer activities, reflective activities, reading and writing activities as well as ones that required the student to search the web for specific information. Writing and reflecting activities were followed by an online form which the student completed. Questions, in relation to a reading, encouraged higher order thinking or reflection. During the first year, 1997, these entries were emailed to the lecturer and to the student so each had a record of the entries. This enabled the lecturer to monitor progress and give feedback when appropriate, as well as encouraging reflective practice in the teachers. Entries led towards assignments and some activities were reflective in nature. However, students' copies languished in their email boxes and were not easily accessible by them. The following year, 1998, the scripting was altered so that these entries accumulated in a private (to student and lecturer) web page, thereby creating an electronic journal for each student. Entries were still emailed to the lecturer so that they could provide formative feedback. Consequently a record of student progress over the two years was constantly available to them in a easily accessible form. Students responded very positively to this new innovation. They were able to refer to previous entries when writing assignments. One student commented "the course journal allows for easy referral for assignments and makes you use it in order to keep track of your work" (male primary teacher).

A listserv, 'et', was set up for students. Here they shared ideas and resources, discussed issues and asked questions. As well as belonging to the et listserv, teachers were encouraged to join national and international listservs. Local students have always had the opportunity to attend a weekly Drop-In session in the Centre for Educational Multimedia at UNITEC. To cater for students in other parts of New Zealand, weekly virtual Drop-In sessions were held using the chat facility of the instant messaging program, ICQ (I Seek You) (Mirabilis, Online). This was fun as we all experimented with appropriate ways of using it – a prime example of teacher-as-learner! These technologies were all used to create a community of online learners where experiences are shared in a safe environment.

To take advantage of these technologies and the opportunity for easily sharing information, the ethics and equity assignment was changed from students just focusing on their own organisations to also find out how other organisations were addressing these issues and make comparisons. They contacted other students by email or ICQ to share policy documents, discuss strategies and reflect on the situation in their own organisation. This was also the beginnings of establishing a learning community.

During 1997 other courses were developed for the web and at the beginning of 1998 all seven courses were available online and the print-based folder ceased to be sent out. Dreamweaver was used to edit the pages but, because of the complex scripting on some pages it was still highly dependent on the technician. In 1999 UNITEC made the decision to use Blackboard software for all courses. The Programme Leader was very reluctant as it was feared that the interactive nature of the current activities would be compromised. However the use of Blackboard brought many positive surprises.

Phase Three: Blackboard

All seven courses were transferred to *Blackboard 4* over the summer of 1999/2000. The original HTML scripting was kept in place where possible. The scripting on the forms was altered to continue to enable electronic journals for the students. However they did not generate separate web pages but were stored on a different server as individual files. This meant that students retrieved the original entry when they clicked on the Journal button and were able to edit their work. The disadvantage was that these were not accessible to the lecturer who then could not provide formative feedback.

A number of extra features were now available to the Programme Leader. These features include a discussion board, virtual chat rooms, whiteboards, group pages and group tools. Thus external programs such as ICQ and the et listserv were no longer needed as all communication happens within the *Blackboard* software. Assessments were altered to include discussions on various issues and collaborative activities.

The ethics and equity assignment was changed yet again. Although the substance did not change, the mode of learning did. The Discussion Board was used to discuss and share ideas. The power of this new medium quickly became apparent. The depth and detail of student interactions was quite outstanding. Whereas previously they had concentrated a lot on factual and legal aspects of the topics, here they discussed the human and organizational implications from a position of personal experience which was then linked to the literature. Some students reported that change occurred in their organisations as a result of these discussions. It was evident that real transfer of learning had occurred. Discussions are assessed using the criteria of; regularity of contribution, sharing of own ideas, building on others ideas, understanding of the issues demonstrated and reference to the literature.

In the second year, when studying the course, *Teaching and Learning with Telecommunications*, students are asked to undertake a group collaborative assignment and prepare a presentation to their colleagues which examines related issues. Group pages are set up and students use the private areas available to them to plan and prepare their presentation. Tools available are a discussion board, chat, file exchange and email. The Discussion Board and archives of the chat area are accessible by the lecturer so progress can be monitored and intervention made if necessary. This gives the students confidence that they are on track, or guidance can be given if not, and enables them to move forward. Adult students also sometimes need assistance with collaborative skills and learning strategies. The group presentation is handed in using the Drop Box.

Blackboard 5 would not allow the inclusion of scripting for the journals, but a pop-up Electric Blackboard window appears in the Student Tools area. However this is just one window for a whole course and is not available from the course materials page where the question or activity is. Students are referred to the Electric Blackboard but the lecturer has no way of knowing if this is used or not. Future development could included an Electric Blackboard Button that the lecturer could insert under each activity. Students would then have a pop up Journal for note taking where and when they need it.

The use of the *Blackboard* tools has facilitated the use of authentic learning activities to develop motivated, knowledgeable, strategic, reflective and socially interactive learners. It has also contributed further to the learning community that has evolved with the course. The student web pages, with a photo, means that students can easily contact others who are in similar organisations with similar roles. They not only communicate via email but some have also visited others in their schools. Students are also encouraged to become part of the wider education technology community. Graduates of the programme are used as experts both face-to-face in study blocks and on occasions appear as a guest on the Discussion Board. The confidence that they gain using the web for learning in a safe and secure environment empowers them to become active contributors to the national listserv, *nzcomped*.

Evaluation

When the programme first moved to a web-based environment student evaluations were by way of email. As well as general course evaluation questions, they were asked to comment on the advantages and disadvantages of the online delivery aspect of the programme. Subsequent evaluations are part of the survey facility in *Blackboard*. Students complete these at the end of each course. At the conclusion of their studies students are asked to comment on the programme as a whole and the online learning experiences they have had. The following discussion comes from a combination of all of these forms of evaluation.

Advantages of having the Programme Online

Generally students have responded very positively to the online environment. They like the fact that they can study and access course materials at either their workplace or at home, and also at a time that suits them. This is especially so for students in remote areas who traditionally have not had access to professional development opportunities. The self-paced nature of the course materials and activities are seen as an advantage. Communication via asynchronous technologies, such as email and the discussion board, have been more successful than the synchronous ones of ICQ and Virtual Classroom. Students often find it difficult to 'meet' online at a specific time. As a lecturer it is not easy to find a time that suits the busy lifestyle of all students. However one student noted that, "the use of the listserv and ICQ encourages and involves students in a more collaborative approach to learning" (female secondary teacher). They reported that this collaborative approach to learning was facilitated by the ability to communicate with other students via email, the discussion board and to share files.

Students also commented that they had more personal contact with the lecturer by using email, "help is only an email away". Another advantage of learning online was the increase in their computer skills. They recognized that "nothing makes you learn how to do something like doing it yourself" (female primary teacher).
Students appreciate access to online references such as those within the course materials, the library catalogue, and more recently, the online databases that UNITEC subscribes to. One

student commented, "this approach is good for people who are pretty busy and need access to material quickly".

The views of the students can be summed up with these two quotes; "overall I think this is an excellent way of learning for me and suits well the time I have available and the level I am at." (female primary teacher) and "the information we have access to is relevant and up to date" (female primary teacher).

However, disadvantages and frustrations of learning online were also noted by the students.

Disadvantages and Frustrations of Online Learning

While students noted positively that learning online increased their computer skills they also realized that there was a huge learning curve to be undergone until they felt comfortable and confident with both the technical aspects and the web as a learning environment. The hypermedia aspect of the web made it easy for them to get lost and the fascinating nature of much of the material they found often caused them to lose focus on their primary task. Many commented on the time that learning online took. They had to get used to the new idea of the computer as a source of information and adjusting from paper based material. This highlights the importance of online learning guides and support for students, especially in the early stages of their studies. Students noted that they had to be self motivated and self monitoring. Some found it more difficult to keep a record of what had been done, for example the Journal entries.

While many reported the advantage of communicating with students others found it difficult to establish personal relationships. They acknowledged that often they needed to take the initiative in initiating communication with others.

A few commented on physical disadvantages such as difficulties they had with reading and reflecting on screen. One student, suffering from arthritis, found it difficult working on the keyboard all the time while others lamented their lack of typing skills. Competing with other family members for time on the computer was a disadvantage in a few cases.

Technical issues were often cited as a disadvantage especially if the UNITEC server, or the server of another site was down. Speed of access was another issue, especially for those in more remote areas. Cost of access was also noted as a disadvantage.

Conclusion

The Graduate Diploma in Education Technology has continued to be developed over the course of the last seven years using the latest web technologies and teaching techniques. Student feedback is largely positive about the online learning environment that has been created and the developers endeavour to move swiftly to address any issues identified by students as a barrier to their learning. This could be either a technical issue or one to do with learning activities. Students appreciate the contact with other students who are teachers from the various sectors, primary, secondary and tertiary, and enjoy being able to participate in discussions. The quality and depth of discussion on a range of issues is very rewarding for both students and lecturer. By using these technologies for their own learning, students become confident and competent to try them with their own classes, whether they teach five year olds or adult students. The Programme Leader is continually striving to use the technologies available to create effective online learning experiences.

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DEVELOPING GENERIC TOOLS FOR USE IN FLEXIBLE LEARNING: A PRELIMINARY PROGRESS REPORT

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Abstract

This paper presents a description of the Australian University Teaching Committee (AUTC) funded project titled: "Information and Communication Technologies (ICTs) and Their Role in Flexible Learning" that aims to provide opportunities for university teachers to create high quality flexible learning experiences for students. This is to be accomplished by the development of a range of software tools and templates based on previously successful ICT-based learning projects in a form which will enable teachers in other settings and subject areas to create similar learning environments for their students.

The project is a two-year endeavour and began in November 2000. The purpose of this paper is to describe the expectations and outcomes of the project and to give an update of what has been achieved so far.

Keywords

learning designs, learning design templates, reusable learning objects, higher education

Introduction

A dominant theme in the discourse about higher education over the last decade is that universities are, or should be, in a process of change (Collis, 1998; Cunningham, Tapsall, Ryan, Stedman, Bagdon & Flew, 1998; p. 5). Perhaps the most significant change that is occurring within universities, particularly in Australia, is the "rush to embrace flexible and alternative teaching and learning approaches and delivery methods" (Corderoy, 1998; p. v). As Nicoll (1998; p. 301) states, "flexibility in learning has come to the fore as a newly dominant metaphor within the Australian university sector".

A review of the following literature (Baldwin, 1991; Collis, 1998b; Cunningham, 1998; Cunningham et al. 1998; Flew, 1998; MackNight, 1996; McNaught, 1998; Nicoll, 1998), suggests that the driving factors for change within universities coalesce into the following set of interrelated issues:

1. The changing nature of the "university" and its client market;
2. Economic and government policy pressures;
3. The growing capability and importance of information and communication technologies (ICTs); and
4. A growing sophistication in understanding of how students learn.

There tends to be general consensus among experts that the forms of learning environments most effective for meaningful learning in higher education are those that are based on the contemporary theories of learning which support knowledge construction through learner-centred settings (e.g. Duffy & Cunningham, 1996; Bostock, 1998). These perspectives about learning are challenging conventional teaching approaches. For example, Cunningham et al. (1998) state:

> The growing acceptance of new educational philosophies and practices, such as constructivism and action learning during the 1980s, have challenged the valence of the didactic lecture/tutorial/textbook model common in higher education, promoted the notions of the academic role as 'a guide on the side' rather than 'the sage on stage', and conceived of the student role as one of independent self-directed learner. (p. 25)

The growing awareness of effective and meaningful teaching and learning plus the recent developments in ICT has led to synergies emerging between the use of ICT and the adoption of powerful learning strategies. The Web is one technology that shows particular promise for supporting meaningful learning through its remarkable functionality, support for flexible delivery modes and capacity to link and connect those involved in the learning process (e.g. Duschatel & Spahn, 1996; Levin, 1999). The possibilities exist for rich learning based on this technology, but for the most part, pedagogically sound and exciting Web courseware tools have yet to be developed to take advantage of such opportunities.

One of the key issues is that the pace of change of emerging Web technologies is so rapid that pedagogical models may be needed to help create Web tools from a learner-centred perspective (Bracewell, Breuleux, Laferrière, Benoit & Abdous, 1998). Salomon (1998) has supported this concern and has noted that for the first time in history, technologies are outpacing pedagogical and psychological rationale. However, a body of literature is starting to report on innovative tools, with strong pedagogical underpinning. Bonk and Cummings (1998) have reported on interactive tools for online portfolio feedback, profile commenting, and Web link rating, while Oliver and McLoughlin (1999) are building tools for online debate, reflection, concept mapping and student surveying and discussion.

The uptake of ICT as a delivery medium for mainstream teaching has been slow and a number of factors have emerged in the past as impediments to the successful uptake of ICT in any educational setting. These include:

1. A lack of access to appropriate ICT infrastructure for learning purposes (e.g. Green, 1998);
2. A lack of ICT literacy among academics and teachers (e.g. Collis, 1998);
3. Poor pedagogical understanding and beliefs (e.g. Gold, 1999);
4. Insufficient and inadequate ICT-based exemplars and cases for academics to model (e.g. Tsichritzis, 1999);
5. Dearth of appropriate instructional materials and software for classroom applications. (e.g. Mioduser, Nachmias, Oren & Lahav, 1999).

Current settings hold fewer impediments to ICT uptake than have been present in the past. Universities within Australia have moved swiftly in recent years to develop the necessary infrastructure to support ICT as a delivery medium and most universities now boast a solid ICT infrastructure aimed at supporting teaching and learning programs. The uptake of ICT as a delivery medium has been supported by professional development programs and activities aiming to develop the ICT literacy of staff plus clearinghouses and Web sites for dissemination of information about ICT in teaching. Funding has been applied by government sources to support the development of university teaching and learning and many organisations now exist that support and promote quality teaching as a scholarly pursuit. Among the major impediments that still stand are the lack of quality teaching and learning models and appropriate instructional material and software for teachers to apply.

This project aims to provide some relief to these impediments by identifying and creating quality resources for generic and mainstream application and by providing appropriate support and resources that will guide and encourage their use. Projects of this type, which support the current trends, should result in a coming decade that witnesses a growth in pedagogically based learning technologies.

Aim of the Project

The aim of this AUTC project is to assist university teachers to create high quality flexible learning experiences for students by providing a range of generic resources/tools/templates that draw upon successful flexible learning projects that utilise ICT and which may be generalised beyond the scope of the individual project. Successful ICT-based learning projects are those that facilitate high quality learning experiences for students.

The study conducted by Alexander and McKenzie (1998) highlighted that one contributing factor towards a successful learning outcome for an ICT-based learning project was the learning design employed. Thus, this project will strive to accomplish its aim through the following process:

1. The identification of a range of learning designs that have been demonstrated to contribute to high quality learning experiences and which can be applied generically;
2. The design and subsequent development of a series of re-usable software, templates and/or exemplars for the learning designs previously identified; and
3. The development of a series of guidelines for good practice in the use of or implementation of the software, templates and/or exemplars in new contexts.

Crucial to the success of this project is the development of an evaluation instrument with a twofold purpose:

1. To facilitate the identification of learning designs that foster high quality learning experiences; and
2. to provide a mechanism to determine whether such learning activity designs have the potential for re-development in a more generic form.

This evaluation mechanism is referred to by the project as an *Evaluation and Redevelopment Framework* (ERF).

For the scope of this project, the terms "learning designs", "high quality learning experiences", and "flexible learning" are defined as follows:

Learning designs: refer to a variety of designs that support student learning experiences. Learning designs may be at the level of a whole subject, subject component or learning resource (Project Brief, 2000).
High quality learning experiences: refer to experiences resulting from an environment, which encourages students to seek understanding rather than memorisation (only for the purposes of assessment), and which encourage the development of lifelong learning skills.
Flexible learning: refers to an educational approach that meets the diverse needs of students. The project is to focus on how ICT can be used to design flexible opportunities for students.

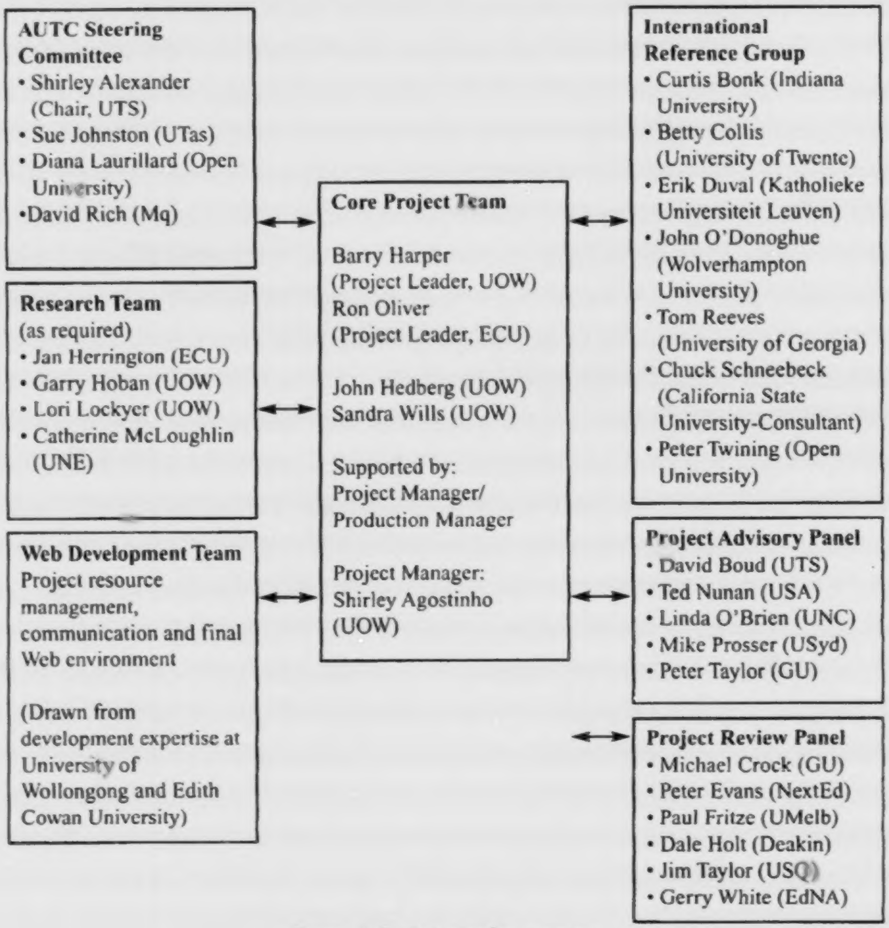
Project Structure

The project began in November 2000 and is structured against four milestones:

- *Milestone One (May 2001):* Development of the Evaluation and Redevelopment Framework
- *Milestone Two (November 2001):* Identification and documentation of learning designs that foster high quality learning experiences and that have the potential for redevelopment in a more generic form.
- *Milestone Three (June 2002)*: Development of a selected number of learning designs in a generic form to at least prototype stage.
- *Milestone Four (December 2002):* Completion of the development of learning designs in a more generic form and finalisation of a web site that will store the project's developed resources.

The project team structure established for this project is illustrated in the Figure 1.

The Core Project Team is responsible for the overall plan and progress of the project. The Research Team has worked closely with the Core Team in the development of the project's ERF. The Project Advisory Panel has provided ongoing guidance and advice to the Core Team in the conceptualisation and development of the ERF and the Project Review Panel and International Reference Group have served as reviewers of the ERF.



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- Sue Johnston (UTas)
- Diana Laurillard (Open University)
- David Rich (Mq)

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Project resource management, communication and final Web environment

(Drawn from development expertise at University of Wollongong and Edith Cowan University)

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Project Review Panel
- Michael Crock (GU)
- Peter Evans (NextEd)
- Paul Fritze (UMelb)
- Dale Holt (Deakin)
- Jim Taylor (USQ)
- Gerry White (EdNA)

Figure 1: Project member structure

Development of the Evaluation and Redevelopment Framework

Characterising High Quality Learning

A major project activity has been the critique of what constitutes "high quality learning". Professor Boud and Associate Professor Prosser were commissioned, as two leading thinkers about learning in higher education in Australia, to develop a paper on high quality learning. Their ideas together with feedback from the project team led to the development of a set of "Key Principles for High Quality Student Learning in Higher Education—from a Learning Perspective" (Boud & Prosser, 2001). The key principles describe four main characteristics that underpin high quality learning in the higher education context. The principles are elaborated through a series of questions that provide a lens through which learning environments can be explored. The four principles are holistic in that they incorporate both learning outcomes and learning processes and are based upon an experience-based learner-centred view of learning. The four principles are outlined below in the form of descriptions of high quality learning activities.

High quality learning activities:

1. **Engage learners through:**
   - Building on their learning intents generally and their particular expectations of the activity in question;
   - Acknowledging and taking account of their prior experience, both their knowledge and experience of situations which might impinge on the present ones;
   - Mobilising their will and desire and developing some kind of emotional engagement with the task in hand;
   - Providing them with a sense of agency with respect to the activity or significant parts of it; and
   - Recognising that learning is a social act and involves other learners for at least part of the activity.

2. **Acknowledge context through:**
   - Involvement with problems in context;
   - Recognising the context of the learner (who may see themselves as decontexualised);
   - Maintaining an awareness of the cultural assumptions and stereotyping which may be incorporated in the context;
   - Situating learning tasks within disciplinary or professional or practical knowledge as appropriate;
   - Taking account of the site of application of what is to be learned (this poses different challenges when the learner is currently engaged in the site of application and when they are not);
   - Appreciating the knowledge demands on students and equipping them to deal with them; and
   - Ensuring that there is a clear alignment between the activities in which students will be engaged and the ways in which they will be assessed.

3. **Challenge learners through:**
   - Prompting them to seek and discern variation in the knowledge and experiences in which they are involved;
   - Questioning the assumptions they bring to the activity and the assumptions they develop through it;
   - Encouraging them to see what is provided as a means to wider ends and go beyond what is provided; and
   - Creating situations in which they are required to take responsibility for their own learning and to shape the activity to their own ends.

4. **Involve practice through:**
   - Demonstrating what has been learned for themselves and for others;

- Gaining feedback at strategic points in learning, but also recognising that finding ways of gaining feedback for one self other than that provided is also important;
- Reflecting on and making sense of their experiences. Continuous exposure to new activities without integration and consolidation within the learner's framework is not conducive to good learning; and
- Developing confidence in performance from practice.

Developing the ERF Instrumentation

Two workshops were conducted early in 2001 to build and review the Evaluation and Redevelopment Framework (ERF). Members of the Core Team, Research Team and Project Advisory Panel attended each workshop. The purpose of the first workshop was to develop an initial draft of the ERF. Whilst the Boud and Prosser principles formed the basis of the ERF, the following issues raised at the workshop also needed to be incorporated into the instrument:

- How technology is embedded in a learning design and how its use supports or hinders the learning experience.
- The issues of scalability, transferability, and technology affordances.
- To determine suitability of redevelopment of a learning design, the ERF should provide a mechanism to glean the critical design features from a learning design and consider how these design features could be implemented in a more generic form.
- To place the review framework within a staged process which might inform the project through a series of critical decision points.

The first complete version of the ERF was devised by the Core Team and Research Team after the first workshop. This version was formatively evaluated in the second workshop (scheduled one month after the first). The Research Team also examined existing evaluative instruments to determine whether these could inform and/or be incorporated into the project's ERF (Oliver, McLoughlin & Herrington, 2001). The findings revealed that overall, there appeared to be no significant gaps in the project's ERF.

Since the second workshop (held at the end of April 2001) the ERF has undergone further review and formative evaluation. Feedback from the Project Review Panel and International Reference Group has been considered and via discussions with the Core Team, Research Team and Steering Committee, a revised version of the ERF has been developed. A challenge for the project has been how to elucidate the key and/or unique elements of the learning design that enable the facilitation of a high quality learning experience for students. The strategy thus adopted is to request a description of the learning design by the designer(s) in a contextualised form in terms of the following:

- The learning activities (and their sequence) that students are required to do.
- The resources that are required to support the activities.
- The support mechanisms that characterise the learning design, e.g., role of the instructor, establishment of collaborative teams, etc.

In addition, all resources utilised by the students along with any evaluation data or findings are also to be submitted.

The ERF is to be implemented in two phases. The purpose, process and outcome for each phase are outlined in the following table.

PHASE	PURPOSE	PROCESS	OUTCOME
Phase 1	• Identify and describe the learning design • Assess the data sources provided and determine whether to proceed to Phase 2	Completion of two instruments: 1. *Learning Design Submission Form* – to be completed by the designer(s) of the learning design 2. *Learning Design Assessment Form* – to be completed by the Project Manager on receipt of the completed *Learning Design Submission Form*	Detailed description of the learning design from the designer(s) Decision whether to proceed to Phase 2 (If to proceed to Phase 2, details about Evaluation Team specified.)
Phase 2	Evaluation of the learning design in terms of: • Its potential to facilitate high quality learning experiences for students. • Its suitability for redevelopment in a more generic form	Completion of one instrument: *Learning Design Evaluation Form* The instrument comprises eight questions: • Questions 1 to 4 address the potential of the learning design to foster high quality learning • Question 5 addresses how the technologies employed facilitate the learning design • Questions 6 and 7 are designed to elucidate the key and/or unique elements of the learning design • Question 8 requires a judgement to be made about whether the learning design is suitable for redevelopment in a more generic form The questions are to be answered by reviewing the submitted data sources and the completed *Learning Design Submission Form* The instrument is to be completed individually by two evaluators. The evaluators are to reach consensus and submit one completed *Learning Design Evaluation Form* to the Project Manager	• Judgement of the potential of the learning design to foster high quality learning. • Generic description of the learning design. • Judgement of the learning design's suitability for redevelopment in a more generic form

Table 1: ERF implementation

The Next Stage of the Project

The next stage of the project will focus on applying the ERF to a number of Learning Design exemplars. The outcome from this activity is intended to provide:

1. Documentation of Learning Designs identified as having potential for redevelopment in a more generic form; and
2. A formative evaluation of the ERF and its operationalisation to a level of "robustness" deemed adequate by the project team.

As this paper goes to press, the Project is in the process of conducting the following activities:

- Identifying potential ICT-based learning exemplars for examination.
  It is anticipated that twenty to thirty examples may be evaluated. Some strategies employed to compile the list of exemplars include: nominations made from the project team, review of past CUTSD (Committee for University Teaching and Staff Development) projects; and a review of relevant literature sources.
- Establishing the ERF Evaluation Team.
  The ERF Evaluation Team will comprise national and international experts in the use of information and communication technologies for teaching and learning in Higher Education.

Nominations have been made by the Project Core Team and by participants who attended the NCODE-Flexible Learning Australasia 26 conference in July 2001.

- Reviewing and finalising the processes associated with the implementation of the ERF, compiling the evaluations, and making final decisions about the learning designs that merit redevelopment.

The ERF instrumentation, ERF Evaluation Team and the list of ICT-based learning exemplars to be evaluated by the project is accessible from: http://www.digitalmedia.uow.edu.au/autc.html.

The project is also examining work being conducted by a number of national and international projects working in similar fields, for example, Ariadne (Online), MERLOT (Online) LRX: (Online) and SoURCE (Online). It is intended to continue additional, purposeful and well-structured interaction with these groups to ensure dissemination and sharing of results.

As the process of submission and evaluation of learning designs is worked through, the project team will also review the potential of developers (with due consideration of the specific knowledge and skill of the original developers and their intellectual property) and assess the specific development skills directly available to the project team. Additionally, the quality of design necessary for this level of production will be an important consideration.

As the project proceeds, we are also considering the planning of support structures to facilitate the adoption and use by teachers of the resources that are developed. At this stage, the project has established links with NCODE to facilitate this process and will work with this group to ensure the maximum potential is obtained for the uptake of the project's outcomes.

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QUALITY GUIDELINES FOR ONLINE COURSES: THE DEVELOPMENT OF AN INSTRUMENT TO AUDIT ONLINE UNITS

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Abstract

Institutional, national and global pressures demand that universities address issues of quality in teaching and learning. The maintenance of existing courses and the imperative to offer new courses online necessitates the development of measures and guidelines that can inform instructional designers and academics. A number of quality guidelines have been produced that reflect different contexts and purposes. Some focus on school learning, some on pedagogy alone and some that reflect the designs of particular courseware management software. This paper sets out to describe a workable set of guidelines for academic and support staff in the development and benchmarking of online course quality across the institution that emphasised current approaches to teaching and learning in higher education supported by appropriate content and delivery strategies.

Keywords

quality, online, guidelines, teaching and learning

Introduction

Developments in information and communications technology also fundamentally change the way we think about inputs and quality. A focus on staff/students ratios and the number of

> volumes in a library is being replaced by a focus on the quality of educational opportunities and outcomes rather than the magnitude of inputs (Kemp, 1999).

We have reached a point in the uptake of technologies in higher education where the notion of quality is becoming an important and overriding issue. Many universities are now offering courses and programs based on online delivery modes and are starting to question aspects of these forms of teaching and learning. Questions that are being asked include:

- Is online learning as effective as face-to-face?
- Are online courses as good as they could be?
- What is the best way to deliver online courses? and
- By what means can we measure quality online learning?

All these questions are raised frequently in the literature and more often than not the answers tend to suggest that quality is often compromised in online learning settings (e.g., Noble, 1997; Stoll, 1995; Nieuwenhuizen, 1997).

As well as institutional concerns there are national and global pressures that demand a focus on quality. Comparisons between the extent and nature of online university course are gathering pace. In May 2001, the *Department of Education, Training and Youth Affairs* (DETYA) surveyed all universities seeking information on the extent to which they provided web-based courses and units, online administration and online support services. Non-government initiatives also see a profit in making such comparisons, such as the *Good Universities Guide* (e.g., Ashenden & Milligan, 2000) through its publication of students' responses to the *Course Experience Questionnaire*. The establishment of the *Australian Universities Quality Agency* will, beginning in 2002, audit all quality assurance aspects of universities once every five years. The process will include the 'monitoring, reviewing, and providing reports on quality assurance arrangements in self accrediting institutions, and on processes and procedures of State/Territory accreditation authorities, and on the impact of those processes on quality of programs' (Kemp, 1999).

Globally, the recent strategic partnership formed between ECU and the distance education broker *Scottish Knowledge* has meant a rapid entry into a competitive global marketplace for quality online materials. Aggressive competition from overseas providers range from courses being offered by 'all star' casts (Reeves, 2001; Radford, 1997) to MIT's recent decision to offer its online courseware free of charge (Krazit, 2001).

So within this context the authors of this paper set about constructing a set of guidelines that would measure the quality of existing online resources and guide the development of new ones.

Quality Guidelines

There is a plethora of literature that describes the attributes of effective learning settings and in particular, the effectiveness of online settings. Many papers have been written describing the attributes of effective learning in higher education (e.g., Ramsden, 1992; Chickering & Ehrmann, 1994) and effective learning in online learning settings (e.g., Burbules & Callister, 2000; Carr-Chellman & Duschatel, 2000; Reeves & Reeves, 1997). At the same time, we frequently find papers that describe evaluation instruments and mechanisms that enable practitioners to determine the likely effectiveness of particular online courses (e.g., Beck, 1997; Reeves & Laffey, 1999). The content of these papers are often very similar, but the papers differ in the ways in which they contextualise their information and seek to use it.

Online learning evaluation instruments have been developed to serve a variety of functions. For example:

- To explore the potential effectiveness of online courses;

- To compare online courses;
- As a formative tool to guide and inform the development of online learning materials;
- For summative purposes associated with establishing the quality of existing materials;

While the determination of the quality of online materials will ostensibly use the same principles as most evaluation instruments, the purpose at Edith Cowan University was to provide a measure of the quality of existing materials and to provide a guide in the development of new units. To achieve this we needed to discover or build an instrument that identified the strengths and weaknesses of online learning materials and reported these elements in an efficient and succinct fashion.

Different writers argue that effective online learning materials must display a number of critical elements. For example, Vaile (1999) argues that there are 6 categories that need to form the basis of an evaluation of the effectiveness of an online learning in K-12 school settings:

- *Learning design:* the pedagogy (including creative thinking, learning modalities and styles, and the particular learning approaches)
- *Curriculum and standards alignment:* the extent to which curriculum and standards match learning objectives
- *Educational content:* the quality of the content or subject matter, organization of content, bias, sensitive content, and scope
- *Learner support resources:* the prevalence of acceptable use policies, documentation of procedures and other support for learners
- *Teacher support resources:* the extent of the instructional and support materials for teacher use
- *Site design:* the quality of the interface, graphics, and multimedia design.

Alley (2000), likewise, argues the existence of 10 critical elements in effective online learning that focus totally on pedagogical design:

- Knowledge is constructed.
- Learning is more effective if a student can take responsibility for her own learning.
- Student motivation is a strong determinant of the outcomes and success of learning.
- Higher order learning requires reflection.
- Learning is unique to the individual.
- Learning is experiential.
- Learning is both social and private.
- Inexorable epistemological presumptions can misdirect higher order learning.
- Learning is spiral.
- Learning is 'messy'.

Similarly, Barker (2001) describes a 15-page set of quality guidelines for online education and training prepared for the *Community Association for Community Education* in Canada. The guidelines comprise numerous criteria across such scales as *content, technology use* and *pedagogy*. The extent of these guidelines for evaluating and reviewing the effectiveness of online learning materials, in some ways, hinders more than helps those who seek to undertake review processes.

Along with many other universities, Edith Cowan has adopted the courseware management software *Blackboard* for the standard delivery software that will enable all academics to provide a web presence for their courses. This move made it imperative to provide guidelines to ensure that materials used within this framework did not perpetuate a didactic model of teaching. The guidelines produced by *Blackboard* in conjunction with the *National Education Association* in the USA (National Education Association & Blackboard, 2000) identified 24 benchmarks for internet based distance learning only three of which related to teaching and learning albeit with a traditional focus—a course approach encouraged, if not explicitly mandated, by the *Blackboard* software.

It was therefore important to provide a workable set of guidelines for academic and support staff, such as instructional designers, in the development and benchmarking of online course quality across the institution that emphasised current approaches to teaching and learning in higher education supported by appropriate content and delivery strategies.

A Framework for Evaluating Online Learning Settings

In previous research into online teaching and learning at our university, we have been mindful of the need for pedagogical re-engineering, a design process where the learning environment is completely redesigned to take intentional advantage of the learning opportunities that are provided by the new technologies (Collis, 1997). Such development would take the place of course re-enrichment, where online opportunities are designed as enriching features to what is ostensibly the same learning program transferred to an electronic mode of delivery.

In research into the design of effective technology-based learning environments, we developed a framework which identified and distinguished between three critical elements emerging from the discrete roles for the principal constituents: *the teacher; the student;* and the *computing materials* (e.g., Oliver, Omari & Herrington, 1998). This research was heavily influenced by our firm belief in the notions of constructivism and social constructivism as theories that best describe how learning takes place. Our current research and development is dealing with the utility of using the principles of situated learning to design tasks and resources to support constructivist learning in online settings.

Situated learning is a concept that recognises the value to be gained from contextualising learning within settings which reflect the purpose of learning and how learners might ultimately apply this learning beyond the classroom (e.g., Brown, Collins & Duguid, 1989). Situated learning encourages learners to construct their own meaning from knowledge and information in the learning process and places an emphasis on interaction and socialisation among learners. The application of this approach to learning suggests the need for a revised framework to reflect the processes involved in flexible and technology-based learning. In such a setting, the critical elements now appear as *the content, the learning activities* and *the learning supports*. While these three elements still reflect aspects of the separate stakeholders, they emphasise more the activities of each in the learning process. These elements provide a strong framework for instructional design and highlight the importance of planning specific roles for learners, the teacher and the technology in the learning environment.

The framework described below was developed at ECU to provide a means for consistent assessment and evaluation of online learning materials. It has been designed in the form of a checklist listing what are considered to be critical elements of effective learning environments. The framework is intended to provide users with the capacity to investigate the potential effectiveness of online units through a determination of the scope and extent of these critical elements. A completed checklist will provide a detailed description to the user of the strengths and weaknesses of an online unit.

The checklist is based around the determination of critical elements within three main areas which describe the complete online setting:

- **pedagogies**, the learning activities which underpin the unit;
- **resources**, the content and information which are provided for the learners; and
- **delivery strategies**, issues associated with the ways in which the course is delivered to the learners.

The following section describes the critical elements within each of these areas and provides examples of how these elements can be manifested in online settings.

Pedagogies

A quality unit operationalises recent theory and research into how people learn. The characteristics identified by this research are evident on the screen in the online learning environment or its suggested implementation. It does not rely on tradition or the teacher's intuition to guide its design and implementation. It enhances learning by enabling the identified characteristics of effective learning environments and ensuring that they are present and accessible.

A quality unit presents one or more learning contexts that reflect the ultimate use of the unit curriculum. The interface reflects real-life contexts, and authentic settings are used wherever possible rather than more academic, decontextualised text-based approaches. Quality units are activity-based rather than content-based, and the activities are complex, sustained and reflect real-life tasks. Students have the opportunity to work collaboratively on products rather than exclusively individually.

In a quality unit, the teacher's role becomes one of coach rather than instructor. The teacher facilitates at the metacognitive level, rather than providing solutions to students' problems. Unit activities and assessment are integrated, that is, students are assessed on unit activities rather than by separate assignments and examinations, and they have the opportunity to present polished products produced collaboratively.

Table 1 presents a checklist of items that can be used to assess quality of pedagogy in online units.

	Description	**Examples**
Authentic tasks	The learning activities involve tasks that reflect the way in which the knowledge will be used in real life settings	Problem-based learning activities using real-life contexts; Learning tasks based in workplace settings Tasks are complex and sustained
Opportunities for collaboration	Students collaborate to create products that could not be produced individually	Tasks are set that require students to collaborate meaningfully Peer-evaluation, industry mentors Buddy systems employed to connect learners
Learner-centred environments	There is a focus on student learning rather than teaching	Teacher s role is one of coach and facilitator Inquiry and problem-based learning tasks Activities support and develop students metacognitive skills
Engaging	Learning environments and tasks challenge and motivate learners	Interesting, complex problems and activities rather than decontextualised theory Activities arouse students curiosity and interests Activities and assessments linked to learners own experiences
Meaningful assessments	Authentic and integrated assessment is used to evaluate students achievement	Assessment is integrated with activities rather than separate from them Opportunity to present polished products rather than simple drafts Opportunities exist for students and their teachers to provide support on academic endeavour

Table 1: The pedagogies used in quality learning materials

Resources

Resources in a quality unit should be accessible as needed by the students in a non-linear format. They should reflect the currency of the subject matter and be regularly updated if appropriate, albeit seminal and important older works should be encouraged. Copyright is always observed.

In a quality unit, resources reflect a rich variety of perspectives to give students the opportunity to judge the merit of different positions, rather than be given a single (the teacher's) viewpoint. Such resources enable learners to access a range of expert opinion from the original source, if possible, rather than through secondary sources. Materials reflect the interests of sometimes marginalised groups, and they demonstrate social, cultural and gender inclusivity. Technology and media are used appropriately according to strengths and affordances, rather than for the sake of technology itself.

Table 2 presents a checklist of items that can be used to assess quality of resources in online units.

	Description	Examples
Accessibility	Resources are organised in ways that make them easily accessed and located	Resources are separate from learning tasks Intuitive and clear organisational strategies Resources are accessible in a non-linear format
Currency	The age of resources are appropriate to the subject matter	Resources should where possible be current and based on regular literature reviews by lecturer Seminal works should not, however, be removed on the basis of age Use of primary resources is made wherever possible
Richness	Resources reflect a rich variety of perspectives	Resources should represent a variety of views (including conflicting views) to allow students the opportunity to assess the merit of arguments Resources provide for a range of perspectives Media are used to enrich data sources
Purposeful use of the media	Media is suitable for the purpose intended	A variety of media is used where appropriate Book on screen approach should be avoided Equally, elaborate multimedia should be avoided when a simple diagram would be suitable
Inclusivity	Materials demonstrate social, cultural, and gender inclusively	Resources include a variety of cultural perspectives where possible Resources avoid gender and culturally exclusive terms Separation of local and generic content to facilitate customisation and adaptation

Table 2: The resources in quality learning materials

Delivery Strategies

Quality units are accessible to people with special needs, such as people with physical disabilities, or geographically isolated students. In a quality unit, the technology is ideally transparent to students. They are able to count on reliability of the technology with robust systems. Students have ready access to the site, and are able to navigate and download materials within a reasonable period of time. The site is not confusing or cluttered, and there are clear directions where appropriate. Unit materials are contextualised, well presented, appealing and easy to navigate.

A quality unit ensures that appropriate communication channels are available to students, and they should be able to use a variety of technologies to communicate and collaborate with each other and their teachers.

Table 3 presents a checklist of items that can be used to assess quality of delivery in online units.

	Description	**Examples**
Reliable and robust interface	The materials are accurate and error free in their operation	Site is accessed reliably Navigation and orientation is seamless Many forms of online support for learners
Clear goals, directions and learning plans	Unit information and expectation of student roles are clear	Students can find information on the website about the unit and its requirements Unit structure makes explicit relationships between learning outcomes, resources, activities and assessments Instructions clearly placed and always available
Communication	The unit provides opportunities and encourages dialogue between students and between teachers and students	Information and communication channels are open and inviting for students Students are encouraged to communicate with the teacher and other class members
Appropriate bandwidth demands	The materials are accessible without lengthy delays	Graphics and other elements checked for download times Delivery formats employ strategies to optimise download times
Equity and accessibility	Unit materials and activities are accessible and available to all students Websites are accessible to disabled students	Course requirements and resourcing made explicit tostudents ahead of the course Students are not hampered by firewalls or geographically sensitive restrictions
Appropriate corporate style	Units adopt a corporate style for websites to ensure a benchmark quality of presentation	Layout and presentation should incorporate common elements on the unit homepage reflecting a corporate style (The corporate style should enhance rather than dictate a pedagogical approach) Fonts, resolution etc should conform to the corporate style where possible, but alternatives should be possible when needed

Table 3: The delivery strategies in quality learning materials

Conclusion

The need for determining and maintaining quality in the process of designing, developing and delivering online learning materials is becoming an important issue for universities and institutions worldwide. It is a process that we at Edith Cowan University have taken seriously for some time and are now in the throes of formalising. This paper has described the development of a quality checklist that we hope will provide guidance to developers and designers and support both formative and summative assessments of our flexible delivery offerings.

The next stage in the process will be to apply the instrument to existing online units to determine its effectiveness. The university employs a number of instructional designers who work with academics across the Faculties and it is with these staff where our initial trialing will occur. As in all quality assessments, this process will be iterative and will result in the need to modify and improve the instrument. A final set of guidelines will then be made available throughout the university for academic staff and other support staff to utilise. It is likely that other institutions in similar situations will find this work of interest and value and we would be very happy to share our experiences with them.

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TOWARDS INSTITUTION-WIDE ONLINE TEACHING AND LEARNING SYSTEMS: TRENDS, DRIVERS AND ISSUES

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Abstract

Universities worldwide are consolidating and enhancing their commitments to various models of e-learning. These activities are leading to the adoption of corporate-wide e-learning systems, and accompanying changes in structures, processes and infrastructure requirements. The professed ideal is to identify narrowly defined corporate IT solutions which can deliver the full range of educational, administrative and student support features to meet the organisational need to expand e-learning activities globally. The trend seems to be away from locally driven and controlled IT development and adoption towards investments in Instructional Management Systems (IMS). In reality, however, universities generally are developing and using a broader array of solutions to meet their needs than may be deemed desirable under a more centralised, corporatised IT approach.

This paper examines these trends by analysing the drivers shaping corporate approaches to IT implementation, and reflects critically on some of the educational, economic and organisational tensions and issues evident in institutional approaches to establishing such systems. The paper highlights the ongoing need for innovative, dynamic organisational solutions to progress the e-learning agenda, and the thoughtful reconciliation of centralised and decentralised approaches to achieving desired ends.

Keywords

instructional management systems, innovation diffusion theory, centralisation, decentralisation, online learning designs

Introduction

Throughout the 1990s, tertiary organisations have been developing flexible program delivery systems, supported by online teaching/learning strategies. During this time, large amounts of institutional and sectoral funding was made available to stimulate educational technology development and implementation at all levels of the institution. However, most activity was driven by local discipline-based initiatives that sought e-learning solutions for educational issues or problems. The emphasis was on improving student learning, and enhancing accessibility to program offerings. As such activities developed, generated by multiple areas of strategic thinking and action, common learning, teaching and technical solutions emerged of relevance across disciplines and faculties. With it came a perceived need for institution-wide approaches to implementing and supporting online teaching/learning systems and a concomitant desire for efficiencies in e-learning practices by adopting a corporate approach to selecting and integrating teaching, learning and administrative systems.

Such a corporate-driven view to achieving quality, efficiency and accessibility pay-offs, was given further impetus by the need to compete effectively in an increasingly global, e-learning marketplace.

This paper argues that various stakeholders with their own particular emphases and desired outcomes shape the e-learning agenda. Moreover, in universities characterised by diverse views about what constitutes desired education, as transferred to or possibly transformed by online learning possibilities, it has become problematic to reconcile, let alone resolve, divergent expectations of what should shape institutional policy in relation to online systems roll-out. The paper outlines valid reasons for increased and decreased centralisation of thinking and effort in this regard. However, it is argued that extreme views to fully centralise or fully decentralise approaches are equally harmful to generating and capturing for the organisation's benefit educational technology innovation, educational program diversity, and a differentiated competitive position in the marketplace. Since the pendulum seems to have swung in recent times to a greater degree of centralisation, the focus of the paper is to consider this trend critically. It is ultimately contended that a balanced, moderated approach is required to ensure all stakeholders and viewpoints are productively acted upon, and to achieve concurrently quality, efficiency and productivity gains. This requires a recognition of the importance of institutional politics in determining e-learning environments.

Background

In the early 1990s, Deakin University merged with two other institutions. Capitalising on the strengths of its antecedent organisations, the University embarked on major teaching program review and rationalisation, underpinned by a strategic commitment to offering flexible teaching programs across its 6 campuses and off-campus (Holt & Thompson, 1995). Currently, 45% (12,661) of the student population is on-campus, 12% (3421) multi-modal, and 43% (12,110) off-campus, with a further 34,500 enrolled in professional education and training through its entrepreneurial arm, DeakinPrime. In line with other universities it progressively adopted new technology to support and enhance the learning experience for both on- and off-campus student cohorts. In fact, off-campus/on-campus modes of enrolment, whatever their continued technical necessity, are increasingly giving way to the new dichotomy of on- or offline education, equally relevant to learning experiences in any mode.

Throughout the 1990s, the University attracted substantial external funds, and also invested from within, to develop its e-learning environments. [See Deakin Interchange pilot implementation (Goodwin, Rice, Stacey & Thompson, 1995) Information Technology Enhancement Program (Holt & Thompson, 1997); Videoteaching implementation (Rice & Spratt, 1999); Online Teaching and Learning Enhancement Project (Holt, Rice & Spratt, 1999)]. Much of this investment was used to address discipline-based concerns, or develop technology systems that showed institutional promise. The University's educational technology program was driven strongly at the 'grassroots' level and by faculty-based strategic thinking and action. The impetus was to improve the quality of learning and extend the accessibility of the University's programs, and associated online service support.

Many of the University's innovative learning, teaching and technology practices were codified in *The Competitive Edge* Deakin's Teaching and Learning Management Plan 2000-2002, and further strategic commitment was made to consolidate, coordinate and build on such developments. The desire to take the University forward in the global virtual learning marketplace led to investment in an Instructional Management System (IMS)[1] in late 1999 (Calvert, 2001). This acquisition reflected the University's desire to embrace a stronger, more centrally-directed approach to the development and use of online learning/teaching throughout the entire organisation. This IMS was implemented alongside other in-house and commercially-acquired IT solutions supporting e-learning at Deakin. A pilot evaluation of the implementation was undertaken in 2000 (Rice, Bowly, Holt & Sims, 2001). Key outcomes of this and preceding IT evaluations conducted at Deakin are drawn upon in the remainder of this paper.

Environmental Imperatives and Stakeholder Needs

For the purposes of this analysis we identify the following five stakeholder groups with vital interests in the implementation of online teaching and learning systems:

- **University senior Executive**, strategic competitive considerations
- **Management of administrative support units**, cost-effective service delivery considerations
- **Management of academic support units**, learning resource management and quality of education considerations
- **Faculty academic management/leadership**, faculty-based competitive and marketing considerations
- **Faculty academic and teaching support staff**, discipline- and program-based educational considerations.

The vital interests of these stakeholders are summarised in Table 1.

1 University Executive	**2 Management, administration units**	**3 Management, academic support units**	**4 Faculty academic management/ leadership**	**5 Faculty academic & teaching support staff**
1.1 Strategic partnerships	2.1 Integration of administrative & online learning systems	3.1 Control of online intellectual property (IP)	4.1 Faculty, school, program approaches	5.1 Perceived relevance to discipline
1.2 Institutional competitive positioning	2.2 Centrally controlled systems	3.2 Cataloguing of learning resources	4.2 Enhancing quality of learning at program level	5.2 Diversity of educational philosophies
1.3 Institutional quality assurance approaches & procedures, e.g. course (re)accreditation	2.3 Centrally located systems	3.3 Rights management of IP	4.3 Achieving desired discipline-specific & generic student attributes	5.3 Diversity of teaching & assessment strategies
1.4 Strategic program developments (with industry)	2.4 Systems running on preferred technical platform	3.4 Quality control of online resources	4.4 Extending accessibility of teaching programs	5.4 Role, nature & purpose of classroom teaching (where relevant)
1.5 Strategically driven staff development	2.5 Economies of scale	3.5 Standards & templates for online resource delivery	4.5 Marketing teaching programs & research	5.5 IT for efficient class management
1.6 Commercialising Deakin learning resources	2.6 Efficiencies in system administration	3.6 Online delivery of academic support services	4.6 Sustainable approaches to faculty-wide media/ technology selection & use	5.6 Local collegial support
1.7 Buying-in external learning resources	2.7 One-stop-shop for delivery of online administration services	3.7 Educational quality of online environments	4.7 Faculty-wide professional development needs	5.7 Local educational & technical support
1.8 Teaching/ learning vision	2.8 Online marketing of courses	3.8 Teaching/ learning-related professional development	4.8 Sensitivity to diversity of teaching needs constituting faculty program portfolio	5.8 Institutional support and incentive, e.g. innovation funding, performance appraisal, promotion
1.9 Organisational restructuring to achieve above		3.9 Media/ technology mixes		5.9 Perceived institutional and faculty leadership pressure to move online
		3.10 Evaluation & research on educational impacts		5.10 Sensitivity to diverse student needs at program and unit level
				5.11 Just-in-time discipline, and individually-based staff development

Table 1: Institutional stakeholders and their vital interests

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Each stakeholder has a diversity of interests and concerns. However, we argue that each tends to have a particular focus in progressing e-learning. Senior Executive's focus is shaped strongly by external environmental threats and opportunities and overall institutional positioning in competitive marketplaces. While strategic initiatives are taken to forge collaborative arrangements within the system, it can be argued that these are motivated by a desire to defend or extend inter-institutional competitive positions. Management of administrative units focus on the cost-effective delivery of administration services to support students and staff, wishing to conserve resources through systems-related efficiency gains. Management of academic support units can have eclectic interests, some siding with efficient administration practices, while others more directly related to faculty leadership and individual academic concerns. Faculty leadership are centrally concerned with the effective management of their teaching programs, achieving the desired quality of learning for the faculty-based student cohort and the competitive positioning of the academic grouping of disciplines overall in maintaining and enhancing funding support for teaching and research. Within their discipline-based programs, individual academics are primarily concerned with achieving a satisfying, quality educational experience with and for their students and themselves. Moreover, many academics are committed to innovatory educational practices and desire a respect for a diversity of viewpoints constituting the world of educational theorising and practice. A case study of IMS selection being driven predominantly by educational stakeholder needs is well documented by Sawers and Alexander (1998, 2000). Whatever criteria are used in choosing an IMS solution, ultimately, academic teaching staff will be the key stakeholder group who determine the nature and scope of adoption of the technology.

Centralisation Versus Decentralisation

Centralisation here refers to control over organisational resources rather than the location of service delivery. Control over the provision of IT resources and services might be centralised whereas the actual points of provision might be decentralised by faculty and/or campus, particularly in geographically dispersed multi-campus institutions (Holt & Thompson, 1998). The issue is the extent to which online teaching/learning developments and associated systems are centrally directed by Executive level action and operationally controlled by academic and administrative support groups on behalf of faculty. In a highly centralised arrangement, power and resources are concentrated at the centre whereas in a more decentralised environment there is considerable latitude and discretion to exercise power locally (i.e. faculty/department level). In the latter case, power is more dispersed throughout the organisation.

The potential advantages and assumptions underlying centralised and decentralised approaches to IT strategies and implementation are outlined in Tables 2 and 3, respectively. The assumptions represent issues/concerns open to debate and conflicting viewpoints.

Potential advantages	Assumptions
1 Agreed to institutional vision of teaching/learning can drive institution-wide investments in IT	1 Institutional vision of teaching/learning reached through consensus and acted upon consistently throughout organisation
2 Online teaching/learning systems can be implemented across the organisation providing consistent teaching and learning environments	2 Ideally one prime online teaching/learning system determined and committed to across the organisation
3 Systems can be easily integrated with other corporate administration applications leading to system efficiencies	3 Online teaching/learning system runs on same technical platform as corporate administrative applications and easily integrated with them
4 Scalable solutions can be deployed and expanded over time in response to total organisational demands for online learning	4 Clear direction and operational planning for systematic expansion of online delivery throughout organisation
5 Learning resources can be stored and delivered in a secure, searchable environment	5 Online system has computer-managed learning and searchable digital object features. Secure, centrally controlled system won't create impediments to publishing resources online
6 Learning resources can be easily monitored to meet quality assurance standards	6 Formal standards of what constitutes quality learning resources understood and adhered to through organisation
7 Learning resources can be developed and produced in standardised templates to QA requirements	7 Standardised templates can accommodate different curriculum designs, pedagogies and assessment strategies
8 Home-grown learning resources can be easily protected and commercialised	8 Significant markets exist for selling online learning resources
9 Home-grown resources can be reused for alternative purposes through organisation	9 Staff are comfortable with their materials being re-purposed and used in different courses offered by the institution
10 Central staff development funding can be strategically targeted to develop staff capabilities in chosen systems	10 Centrally engineered staff development program can impact broadly across a large number of staff in a big organisation
11 Central design, development and production expertise can use the technical system to create and migrate applications across the University	11 Central capabilities have in-depth expertise of the technical platform on which the online system is running to execute desired migration of generic solutions
12 Central system/s can be efficiently administered in one central location by one group of well qualified IT staff	12 In a multi-campus environment, network infrastructure is robust enough to support use of system from one central location

Table 2: Potential advantages and assumptions underlying centralisation

Potential advantages	Assumptions
1 IT development and adoption driven by local discipline/program-based needs and requirements	1. Local units willing and able to articulate and execute on local needs
2 Local ownership of systems' solutions encourages greater commitment to their full integration and mainstream use	2 Ownership and commitment more likely to be negotiated and enacted by smaller more like-minded groups
3 Staff development associated with local system adoption dispersed and delivered in a customised, just-in-time fashion to meet local needs	3 Professional development integral to the task of curriculum development, and development and adoption of online learning driven by curriculum-related needs
4 Local developments are seen to accommodate diverse educational paradigms, teaching and assessment strategies across Faculty programs	4 Universities represent a diversity of viewpoints on what constitutes knowledge, knowing, teaching, learning, and the roles of teachers and learners. These must be expressed through quite different uses of technology
5 In being more responsive to local educational needs, there is greater impetus for innovation, diverse online learning developments, formative evaluation, solutions enhancement	5 Innovation is generated at the local, micro level of an organisation and driven by the need for teaching innovators to address or solve educational problems or challenges relevant to **their** teaching
6 Locally situated and controlled development, design and production support more attuned to delivering relevant services required by teaching staff	6 Organisation resourced well enough to establish local support capabilities able to meet locally generated needs
7 Local developments can evolve over time into key institutional activities to the extent that solutions are adopted at the grassroots level across disciplines, departments/schools and faculties	7 Local development can evolve and take root through the organisation through informal networking, cross-school, cross-faculty collaboration between interested parties (may need central group to be a catalyst for cross-fertilisation and to support progressive migration towards institutional solutions)
8 Local developments can be effectively commercialised so that those involved in their creation have ownership and incentive to see their applications used elsewhere	8 Local developments robust enough to undergo critical external scrutiny and be well maintained and supported over time if sold. Those who innovate receive in part the financial returns for their labours

Table 3: Potential advantages and assumptions underlying decentralisation

A key dilemma outlined in Tables 2 and 3 is that while a centralised system can deliver standardised approaches to materials presentation of possible benefit to student learning, such systems can be constraining in regard to the education design of programs. Technologies that are built on an instructivist model are inherently constraining of the possibilities for customisation based on other educational paradigms. It may be easy to customise the visual form of the material, but less so in regard to changing the features of a system and its educational purpose.

Rationale for the Adoption of Corporate Approaches

As stated earlier, on balance there has been a move to more centralised, corporatised approaches underpinned by the following factors:

- Achieving scalability and administrative systems integration and efficiencies
- Commercialising home-grown learning resources
- Reusing learning resources for alternative purposes within organisation
- Acquiring materials and protecting intellectual property rights of external learning resource suppliers
- Assuring quality of learning resources through adherence to standards of presentation and monitoring resources over time
- Adopting a common online teaching and learning system as a platform for supporting inter-School and inter-Faculty courses and spearheading competitive strategies in the virtual global marketplace.

We acknowledge that most universities have centralisation and decentralisation features and could be reasonably classified as hybrid systems of organisational control. This is a matter of degree, not kind. However, conflicting stakeholder interests and expectations can arguably push and pull the organisation dysfunctionally in one direction or the other, too far in degree as perceived by at least one stakeholder whatever the direction. The outcome of this can be continuing undercurrents of unresolved tension between parties.

Proponents of highly centralised approaches to IT systems argue that benefits would be maximised ideally through the adoption of one fully featured online learning system, well integrated with major administrative applications. Naturally such advocates search for such corporate IT solutions. Those inclined to a decentralised view are concerned about the ability of any system to support a diversity of teaching/learning approaches, and the consequent deleterious effect this may have on educational product differentiation and innovation. As Bates (2000) observes:

> ...any attempt to impose a single course authoring software solution on a whole institution is likely to impose a serious restriction on academic freedom and could lead to a highly undesirable uniform approach to teaching across all subjects. (p. 203)

Moreover, concerns might exist about excessive risk exposure if the organisation has all its 'online system eggs in one basket', particularly given the vagaries of the commercial IT marketplace if off-the-shelf solutions are acquired. One group's focus is more on reaping institutional economies of scale and attendant efficiencies, while the other group is primarily concerned with the ways online systems can dynamically and continuously add distinctive value to the educational experience.

The centralist position emphasises resource conservation and the maintenance of minimal standards. The decentralist position emphasises educational quality, diversity, differentiation and change, with its attendant consequence of some degree of resource wastage. Thompson and Holt (1997) discuss how staff attitudes towards good teaching, quality learning, and the nature of their disciplines, shaped a variety of views on the potential of new technology to assist them in their work. More generally, Peters (1997) argues that the pursuit of competitive advantage in the business world should be fundamentally driven by organisational cultures conducive to innovation in product designs and the avoidance of tendencies towards product commoditisation.

Awkward Realities: Implementing Corporate Solutions

Diffusion of Innovation

The IMS acquired by Deakin was a major new technology for the organisation and hence progress in its implementation can be understood in relation to theory on the diffusion of innovation. The desire to commit to a corporate IMS was clearly underpinned by many of the perceived advantages advocated by those with a centralist viewpoint of the benefits of such investments.

Rogers (1995) quoted by Geoghegan (1996), articulates five characteristics of innovations that influence the rate of adoption and suggest whether an innovation will ultimately impact positively on targeted users:

- The **relative advantage** of the innovation over what it might replace or augment;
- The innovation's **compatibility** with existing online learning cultures;
- The **complexity** of the innovation;
- The innovation's **trialability**, i.e. ability to experiment before adoption;
- The **observability** or **visibility** to other potential adopters of the results achieved by using the innovation.

The rate of adoption of the IMS at Deakin has been steadily, but modestly increasing in the second year of use. The extent to which usage will progress rapidly beyond selected targeted areas for major implementation support, and those who might be seen as early adopters, remains uncertain. Reasons for this might be:

- Teaching staff were inadvertently led to believe that an IMS was a tool that could easily be used to re-purpose their traditional media learning resources into interactive, value-adding multimedia Web-based courseware with minimum time and effort on their behalf *(raising the issue of complexity);*
- The solution is seen to be premised on an *instructivist* view of learning and hence may not be compatible with or supportive of online pedagogies shaped by *constructivist* learning theory *(raising the issue of compatibility);*
- A solution seen to be simple and easy to use was not necessarily one able to accommodate flexibility of design of online learning environments at a level below the general issue of paradigmatic concerns *(raising issues of compatibility and complexity);*
- The general purpose IMS has had to find its niche alongside other specialist technologies used and institutionalised at the University over a number of years, including a major specialist computer conferencing system *(raising the issue of relative advantage);*
- The IMS rolled out through central support agencies and running on a centrally controlled technical platform has had to place itself amongst a range of locally developed, adopted and controlled systems established to meet the particular needs of certain schools, and programs in the University *(raising the issue of relative advantage);*
- Investment in the IMS qua technical infrastructure solution was not accompanied by a substantial investment in supporting teaching staff, at the institutional or faculty levels, to rethink their practices to take advantage of the potentials of the IMS *(raising issues of trialability and observability/visibility);*
- An additional external stakeholder (professions and industry) needed to be considered in using the solution in the University's commercial arm to meet their continuing professional development and corporate training needs through online learning strategies *(raising issues of observability/visibility).*

Clearly, centralised approaches that assume a 'greenfields' site for the introduction of an IMS can run up against the awkward realities of modest steps to mainstreaming caused by entrenched cultures associated with existing institutionalised technologies. The five factors listed above must all be strongly positive to induce voluntary switching from a suite of central and local solutions to a major new centrally directed IMS.

Can One System Do It All?

The University now has a portfolio of centrally and locally supported technologies underpinning its online teaching/learning environment. The IMS is usefully contributing in enhancing the functionality of the University's online activities. This situation may not sit comfortably with stakeholders wishing to see the IMS occupying a more prominent position as the principle e-learning solution at Deakin. Neither is its introduction necessarily going to sit comfortably with those with pre-existing technology commitments and more decentralist tendencies. We contend, however, that the University's best interests have been served through a reasonable diversity of systems, solutions and applications, centrally and locally controlled. This probably resonates strongly with the experiences of many others involved in IT implementation in Australian higher education (see McNaught, Kenny, Kennedy & Lord, 1999). King, McCausland and Nunan (2001) and Davis (2001) have documented such hybrid approaches in the field of open and distance education.

Conclusion

In conclusion, we argue that moderate and reasoned outcomes are best achieved not through stakeholder misunderstanding and inevitable tension and friction, but through the instigation of processes involving all stakeholders, a respect for their rationales and viewpoints, and a reconciliation of differences to ensure a balanced approach. The balance should give appropriate weighting to educational diversity, educational quality, ongoing innovation to ensure differentiation of online offerings, on the one hand, and institutional-wide systems' efficiencies, competitive market positioning, and certainty and stability of IT system's performance, on the other. Clearly, educational needs should be strongly foregrounded in the process.

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Endnotes

1. IMS refers to a system that allows for the creation and delivery of material, online assessment, communication, and tracking of student progress. Increasingly these systems are being referred to as learning management systems. However, we use the acronym IMS intentionally because this is the way the system was described by the vendor and promoted within the University community.

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RECENT DEVELOPMENTS FOR A DISTRIBUTED NATIONAL ELECTRONIC RESOURCE FOR LEARNING AND TEACHING IN THE UK

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Abstract

This paper describes the current JISC funded development programmes for a distributed national electronic resource for learning teaching and research in the UK. It also provides some early evidence for the implications of non-traditional approaches to Higher Education and the ways in which new resources may enhance the learning experience. It demonstrates one particular product currently in development, Virtual Norfolk, which is creating a portal web-site providing full-text access to original historical documentary and image material, plus commentary, directed toward learning and teaching in the higher education sector.

Keywords

learning, teaching, development, online, Norfolk, higher education, UK

The Joint Information Systems Committee (JISC, Online) has responsibility for the provision of network and data services to the whole of the UK's higher and further education communities (JISC – Distributed National Electronic Resource, Online). The JISC aims to bring together much of it's service provision in a managed information environment allowing learners and teachers in higher and further education in the UK to access quality assured learning and teaching resources through the Internet. These resources are very rich and include textbooks, journals, monographs, theses, abstracts, manuscripts, maps, music scores, still images, geospatial images and other kinds of primary research data, as well as moving picture and sound collections.

The JISC funded two development programmes in 2000. In total, £13 million was distributed to 44 projects across the UK for the development of an information environment for learning and teaching. The majority of funding (about £9 million) was allocated to projects for the enhancement and development of materials for learning and teaching. Thirty-three projects were funded in this programme area. They are concerned with the generation of a range of new digital content including still images, moving pictures and sound, multimedia, electronic catalogues and finding aids, as well as specific tailored learning materials. Some projects are enhancing existing JISC service provision of learning and teaching materials. Projects have been clustered to reflect these themes for the purposes of programme and project steering and management and for sharing learning between projects as they progress.

A formative evaluation of the programme has also been commissioned. This is aimed at informing the development of the programme through assessment of the impacts being made by the individual projects on learning and teaching. The project team will also assess the viability and effectiveness of hardware, software and data standards, determine the extent to which the development programme addresses the needs of end users and test user acceptance of the platform on which the resources are made available.

Network technology has made it possible for electronic resources to be provided and accessed throughout the UK. It enables the exploitation of the rich diversity of resources available in the higher and further education community and the development of various delivery modes; interfaces and accompanying support services. JISC's resources have been used heavily in research for a number of years. Increasingly students are able to turn to the Internet and digital resources when seeking material to support their studies. Networked access to digital resources greatly expands the amount of material open to them and can do much to reduce inequalities in resource provision between institutions. Teaching and research staff, apart from being heavy users of digital resources, are also creators. A flexible information environment should allow them not only to create resources that are accessible within their own institution but also to allow them to contribute to and manipulate electronic resources to enhance their learning, teaching and research.

The Virtual Norfolk project (Online) is creating a portal web-site providing full-text access to original historical documentary and image material, plus commentary, directed toward learning and teaching in the higher education sector, in close collaboration with the Norwich and Norfolk Record Office (NRO). The overall aim of the project is to create a web based L&T resource for the discipline of History that can expand its provision to other areas, export its structure to other future projects and encourage collaboration between HE institutions and regional record offices. Moreover, hyper-links will be created between Virtual Norfolk and other useful sites. For example, educational portals such as the UK's National Grid for Learning, archival services such as the British Library, the Public Record Office and the Historical Manuscripts Commission, and other relevant history sites. To this end, and to aid accessibility to all end-users, it is intended that the VN site with be both Dublin Core and Z39.50 compliant. Furthermore, VN is developing collaborative links with many other institutions and projects within the United Kingdom and, to a lesser extent, abroad. For example, the FenPast project which is seeking to digitise the history of the Fenland region of Cambridgeshire, the venerable Victoria County History of England, the National Churches Conservation Trust, Norwich Cathedral; the Dean and Chapter of which are allowing us to digitise and model the interior of the Cathedral for teaching purposes.

The importance of using historical documents as a core element in teaching History has long been recognised. However, research and development are needed to address problems of providing wide student access to such materials, and to investigate the potentials for learning and teaching in light of recent educational and technological change. Within the English context previous experiments with putting the past onto the web for learning purposes have not fully realised their objectives, and many simply failed to engage both the tutors in higher education and their students. An example here would be the Teaching and Learning Tutorial Projects (TLTP). Many of these adopted a presentational approach akin to the old fashioned essay; historians expert in a particular field wrote a paper on that field and the essay was placed on the web. Very little attempt was made to utilise the strengths of medium and the technology, and students voted with a yawn. The Virtual Norfolk project builds upon this earlier work and seeks to provide students and tutors with access to primary source material, or more simply historical documents, instead of just a learned essay. The content of Virtual Norfolk's web site therefore, will differ from similar sites in two main areas. First, the content of Virtual Norfolk will focus upon the Mediaeval and Early Modern periods of Norfolk's past, circa 1200-1850AD, whereas similar sites deal with late nineteenth and twentieth-century material. Second, unlike the overwhelming majority of mediaeval sites that do exist, which deliver their material from edited, mainly published and largely narrative, sources, Virtual Norfolk will be delivering direct archival access to documents unavailable elsewhere other than the Norfolk Record Office. The intention is to embed the primary material within a series of learning and teaching aids to ensure that the site is a flexible and easy to use resource. The inspiration for the approach adopted and developed by VN came primarily from the USA of which two sites in particular spring to mind, the Virginia Centre for Digital History's Valley of the Shadow site, and the Fort Sumter site. Closer to home we drew stimulation from the Birmingham University (UK) Citysite electronic book project and the Wilfred Owen Interactive site among many others.

The County of Norfolk was selected because until the end of the eighteenth century Norwich was one of the pre-eminent cities in England, and for much of that period was the 'second city' after London. What is more, the region of East Anglia, of which Norfolk is a part, was one of the most densely populated, and therefore closely governed, in the British Isles. Thus, the resources for this period archived at the NRO are unparalleled outside the capital, and permit student exploration of the major themes of historical study. Furthermore, the documents housed in the NRO are a resource of interest to scholars both nationally and internationally. The problems in utilising these rich materials are exacerbated by Norwich's comparative geographical isolation therefore, electronic access is ideally suited to the project's purpose.

The core of the Virtual Norfolk web site will be an Extensible Mark-up Language (XML) database consisting of transcriptions and digitised images of original documents (c.1200-1850), and other relevant images (tithe maps, estate maps, wood-cuts, engravings etc), music and video footage. The database will also include reference maps, a bibliography, a timeline, a glossary; a biographical section devoted to notable characters from the source material, and, will be indexed and fully searchable by keyword, date, place etc. The content of the XML database will be researched and produced by the project's team of historians in collaboration with pilot tutors and the project's independent evaluator.

Constructed around this XML database in the first phase of development, and providing organisational pathways through the material, will be learning and teaching packs. Each pack will focus upon a theme, issue or topic from the current historiography and will be suitable for use as either an individual seminar or as the foundation for a complete module. A library of such packs is envisaged, which will allow some limited flexibility for end users. For example, individual packs may be combined to create ready made module pathways for pilot tutors. Alternatively, students and tutors will be able to create their own pathways through the teaching packs to suit their individual learning or teaching requirements on a pick and mix basis from the library of discrete topic packs.

The second phase of development will ensure that the database is fully searchable and that the individual object files can be tagged for complete flexibility of use. The metadata is a vital element of the structure of each object file/document; it will ensure the flexibility required of the site and must be built into the creation of the original document. It reflects individual tutor needs, requirements, and usage thus can only be ascertained in consultation with the pilot tutors and other prospective end-users. The inclusion of well-researched metadata however, will enable the site to attain its goal of providing flexible learning and teaching resource capable of delivering primary materials to students and teachers of history across a broad spectrum of the educational sector.

In the third development phase it is intended to use Scalable Vector Graphics (SVG), a sub-set of XML, to create inter-active historical mapping of Norfolk. The aim is to link as many geographically determined object files to their locations as is possible. In the long term, it is hoped that users will be able to click on to a village and receive a menu of object files associated with that village, and links to related material.

Within each individual learning and teaching pack the user will find links to relevant documentary material and bibliographies contained within the site, contextual commentaries and other useful explanatory guides (for example, biographies of individuals). Links will also be included within the text to other relevant sources or material. It is also intended to include task boxes which could present the user with either suggestions of other documents, tasks or questions, all designed to prompt reflection and thought in the learning process. The intention of the task boxes is to encourage students to think through the material offered, enable them to create their own pathways, and construct their own evidence base to support their interpretations. Thus, Virtual Norfolk ceases to be merely another method of providing (imposing) historical narratives upon the material and student. Instead it will seek to facilitate the development of individual interpretation and understanding of raw documentary material, thereby encouraging a critical awareness of the past and the historian's skills in accessing and representing the past.

To enhance the overall aims of the Virtual Norfolk site and to encourage students to critically reflect upon the process of creating History, it is also intended to include learning pathways that facilitate their acquisition of the basic skills of the historian. For example, it will be relatively easy to construct three Palaeography modules (beginners, intermediate and advanced) from the digitised documents. Thus, students will be able to begin to grasp the complexities of translating the raw material of academic history into contemporary English. Also under development is a module examining the complexities of document interpretation and linkage underpinning the creation of analytic history, and another module using primary sources to examine the historical development and use of descriptive and analytic concepts frequently deployed by historians within their histories. Thus, Virtual Norfolk's use of learning pathways, searchability, and the inclusion of skills based tutorial packs, will allow tutors to impress upon students the *fragility* of *representations of the past* and historical *narratives*. Whether this is perceived to be a good thing or not depends upon the personal views and position of the historian. But Virtual Norfolk is seeking to offer a contribution to a history degree that can be shown to ensure that its graduates can handle and synthesise a wide assortment of material and information into coherent and critically aware argument.

The Project will be using XML for database content management. Using this language will ensure long-term life, technology permitting, to the core material up-loaded onto the project's web site. Moreover, using XML will provide multiple platform compatibility with current technologies and will be capable of incorporating foreseeable developments in end-user interface technology (for example, the WAP phone). The Virtual Norfolk project database will be Z39.50 compliant and readily convertible for use by non-XML browsers. Thus, the project's core deliverables will be accessible to any end-user as the technology now stands, thereby ensuring interoperability across a range of systems. The use of XML also encourages the sustainability of the project's deliverables by ensuring that they are positioned within the foreseeable trajectory of technological development in web design. Moreover, by ensuring the Virtual Norfolk database is fully searchable, and by ensuring that end-users can create their own pathways through the database, the Virtual Norfolk database should prove to be a flexible and responsive learning and teaching tool within a fluid academic learning and teaching environment. It is to be hoped that the example of Virtual Norfolk will encourage other History Departments within Higher Education to explore relationships with local archives and Record Offices with a view to similar collaborations. Part of the dissemination strategy of the project will be to actively encourage similar initiatives with the intention of creating a network of similar Learning and Teaching sites. Moreover, the record and reports, which will be included within the web site for ready public access, charting our procedures and progress will provide an invaluable guide to future work. The use of XML furthers the scalability of both this and similar projects. The use of a central XML database provides an easily managed and expandable format in which to continue to up-load relevant material and continues to respond to individual pathway creation. What is more, the topic format of the teaching packs can be readily customised to respond to end-user requirements as learning and teaching demands change. Thus the Virtual Norfolk web site will provide a flexible resource for the teaching of history which is capable of responding to multiple end-user demands in a variety of educational environments.

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THE CONVERGENCE OF TEXT AND GRAPHICS IN AN ONLINE LEARNING ENVIRONMENT:
A CASE STUDY IN ECONOMICS

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Abstract

While much visually oriented teaching material that uses the new technologies is being developed, there is little understanding or research into the demands such material makes on students' information processing. This paper outlines an innovative approach to teaching complex economic models that incorporates the convergence of text and graphics in instructional material in an online learning environment. The Interactive International Trade (IIT) program is designed to improve the effectiveness of teaching and learning by the effective, efficient and innovative use of graphics as well as equations and text in teaching material on the World Wide Web.

The paper describes the implementation and initial evaluation of this approach to teaching economics. It proposes that the technical capacity to be able to generate dynamic graphics in teaching material needs to be distinguished from the issue of whether or not the generation of dynamic graphics is likely to have desirable perceptual and cognitive consequences for students. The findings will give us some indication of how this type of instructional material is impacting on student learning, identify ways it can be improved and provide some guidelines for the future development of similar material to support student learning.

Keywords

instructional graphics, teaching complex economic models, online learning

Introduction

The particular attributes of an online learning environment potentially extend the didactic possibilities for teachers by providing them with powerful new ways to represent knowledge (Schnotz, 1999). Different information processing demands will be placed on learners as they interpret these different ways of representing knowledge. The cognitive demands of integrating text and graphics appear to differ according to whether the graphic is static or dynamic. Teachers need to ask, "Will these new ways of representing knowledge improve the learning experience of the learner?" and "What needs to be done to support the learner in those cases where additional processing demands are made of the learner?"

The Interactive International Trade (IIT) program was developed by MoonJoong Tcha of The University of Western Australia, for the Department of Economics, with financial support from a Teaching and Learning Initiative Grant. The program is used for three units at present: Asia in the World Economy (400.203), International Trade (400.235) and Topics in International Economics (400.450). The IIT program is an interactive computer program, written in Java and available on the Internet as complementary teaching material for these units (see International Trade, Online).

The development of the IIT program raises many questions. What impact is the IIT program having on students' understanding? Is the IIT program enabling or preventing students in performing relevant cognitive processes? The aim of this paper is to describe the IIT program, to consider the pedagogical and technological aspects of the program and to explain the evaluation process that is currently being undertaken.

The Use of Graphics in the Study of Economics

Economics is the study of human behaviour as a relationship between human wants and the limited resources to satisfy those wants (Miller & Shade, 1995). Economists use models to assist them to understand the abstract features and relationships of the complex economic world. The models used by economists are simplified representations of real world situations. Because the real world situation can be too complicated to include every feature, economists restrict themselves to using the most important features of the real world situation in order to analyse, understand and explain the most important relationships. In order to simplify the real world situation, economists make certain assumptions. The fewer assumptions economists have to make, the more realistic and true to the real world situation the model will be. Ideally a model will show the most important relationships while staying near to the real world situation. Models can be developed as equations, as written descriptions or as diagrams (Taylor, Moosa & Cowling, 2000; Miller & Shade, 1995).

Such an explanation of economic models does not take into account the educational dimensions that need to be considered when developing and using these models. The process of simplifying information into graphic forms can often mean removing information from the graphic that is already in the subject expert's head but is not yet in the novice's head. What is easy for the subject expert to "see" is not as easily seen by the novice. The assumptions the subject experts make are not necessarily apparent to a novice. The subject expert is able to supply missing details and information from a well developed knowledge base and is able to then contextually embed the information supplied by the graphic to build up a coherent mental structure. What the subject expert sees as a graphically simple and economic representation of information is, in fact, a professionally sophisticated representation of information that depends on a well developed knowledge base in the reader. A novice often does not have a sufficiently well developed knowledge base to enable them to build a coherent mental structure of the information embedded in the graphic.

Hartley (1994) classifies signs as either iconic or digital. Iconic signs, such as photographs, illustrations or diagrams, resemble their referent in some way. Digital signs, such as words or numbers, do not need to resemble their referent in any way. In such cases as texts with diagrams, illustrations with captions and symbols with explanatory labels, both iconic and digital sign systems are combined. This distinction seems somewhat simplistic when applied to economic models. While such models may be simplified representations of real world situations, they are dealing with abstract features and relationships of the complex economic world. Lowe (1998) distinguishes levels in representations, or genres, which range from concrete, realistic and literal, such as photographs, through to abstract, such as words and diagrams, and levels in referents, or subject matter, which range from those that are accessible and physical to the invisible and not physical. In economic models, the referent is a real world, complex economic situation. It is invisible and not accessible. The representations are highly abstract. Taylor et al., (2000) state that "economic models can be described with words, with numerical tables, with graphs or with algebra" (p. 16) and claim that "developing an eye for economics as represented in graphs is easier than developing a nose for numbers in tables" (p. 25).

A graph can be defined as "a drawing that presents the changes of and the relationship between two or more things through the use of the visual elements and various forms of visual notation" (Saunders, 1994; p. 185). They are "designed to suggest inferences, generalisations, and evaluative interpretation" in order to help learners gain meaning (Knupfer, 1994; p. 214), but there can often be a contradiction between the author's intentions of helping learners and the actual effect of their efforts on learners.

When 'reading' text or graphics for information, learners need to have knowledge about where to look for the information they need, knowledge about what the elements of the medium are, knowledge about the sequence to follow when reading the medium and knowledge about how to connect the information in each medium.

Conventional wisdom would say that graphics help to explain text, but the reverse is also true. Graphs are not necessarily self explanatory. They need text to explain them. In an economic model, such as the ones in the IIT program, a subject expert may be able to hazard a guess about what is represented but a novice would be struggling to even begin.

Another aspect that also needs to be considered when text and graphs are combined is the cognitive processing load for a learner. Both text and graph compete for the limited attention and processing resources of the learner. The high processing demands of the graph may be better supported by aural (spoken text) rather than visual (written text) means, thus capitalising on two perceptual channels (aural and visual) rather than just the one (visual).

The cognitive demands of integrating text and graphics appear to differ according to whether the graphic is static or dynamic. The willingness of learners to study graphics improves when the graphics are animated but their understanding of the processes illustrated seems to be impaired or distorted (Wright, Milroy & Lickorish, 1999). In some circumstances, the processing demands of dynamic graphics have been found to have a negative effect on learning (Lowe, 1999). Dynamic graphics can prevent learners from performing relevant cognitive processes and so may not be beneficial for learning (Schnotz, Böckheler & Grzondziel, 1999).

Processing Demands of Graphs

The eye is like "an information gathering probe for the brain" (Lowe, 1998). Light reflected or emitted from an object passes through the eye to the retina and this activates an electrical impulse to the brain that is interpreted as a representation of the object. While the essential structural features of the object are selectively captured, the subsequent "image in the brain" is not identical to the viewed object.

The very start of processing (the pre-attentive phase) is likely to be dealing with gaining a global or holistic impression of the graph (Lowe, 1998). Broad scale organisational influences on perception will work to separate the visual information so that the learner can discriminate between the individual parts. Gestalt effects on perception will work to impose structure on the visual information. Because human viewing is highly selective, visual signals that differ substantially from the rest of the visual field, anything unusual, unexpected or in contrast with the surroundings will draw the learner's attention. This needs to be considered when using animation in an online learning environment as it could distract the learner leading to an inappropriate use of the learner's finite cognitive resources.

Like text, numbers and pictures, a graph is a form of information. The learner needs to use two types of information to interpret a graph: their own prior knowledge and the information supplied by the graph. The learner needs to draw on their prior knowledge of the subject as well as their prior knowledge of the elements of a graph. During viewing, the elements of the graph need to be identified and interpreted. The learner needs to reverse the "transformation" from the real world economic situation to the graph. Relationships and changes depicted in the graph need to be identified and converted to the real world economic situation depicted. They need to flesh out the representation of the real world economic situation by relating it to what they already know. How well this is done is influenced by the learner's knowledge of graphs, the learner's knowledge of the subject and the learner's task. Aspects that are obvious to a subject expert may be missed by novices who lack knowledge of the subject area or who lack knowledge about how to read graphs.

Graphs can be explored in a range of different ways depending on the learner's task, needs, knowledge and interest. As hypotheses about the content of the graph are built up and tested by the learner, the learner's viewing behaviour and purpose will change. Attention may be confined to certain aspects of the graph that the learner considers relevant or compelling while other aspects are ignored.

For learners to 'read' a graph, they need to know where to look, what the elements of the graph are, what sequence to follow and how to connect the information. An online learning environment can provide the means to deliver both static and dynamic graphs. Perceptual and cognitive processing demands need to be considered when developing graphs for an online learning environment. Technical constraints also need to be considered.

Development of the Interactive International Trade Program

The students enrolled in the three economics units where the IIT program is currently used have various backgrounds. Some are very good at economics while others are doing the unit because it is required for their degree. Some are international students with English as a second language.

The information in these units contains very complex models, possibly the most complicated in economics. Most economic models look at economic factors in one country. In International Trade, the model has to be understood for one country, generalised to other countries and then the interaction between the two or more countries has to be understood. The static graphs in the textbooks that attempt to explain these are very complicated. The lecturer uses PowerPoint slides or overhead transparencies in classes but has found that students just copy his graphs and then cannot remember what all the lines are about!

The lecturer believes it is important for students to "build up the graphs themselves" (personal communication, March 21, 2001). He reflected on what would be the best way to explain the material and considered using maths, graphs or just talking. He thought that graphs were better because students did not like maths and he, himself, preferred graphs in order to understand the concepts. He approached two computer scientists (one a student) and, with the assistance of grants and funds from the university, taught them economics (both introductory and international). They then wrote the program. The first stage, *Basic models of international trade*, and the second stage, *Trade policies and welfare analysis*, have been completed and have been available for students to use for two semesters. A third stage is to be developed once the evaluation of the first two stages is completed. The lecturer considers the main benefit for his students as the ability to access the material "whenever, wherever, without cost".

Description of the Interactive International Trade Program

The IIT program has two parts:

- Basic models of international trade;
- Trade policies and welfare analysis.

The material is presented in two versions:

- A non-interactive version – the preferred option for printing. This version has been supplied for those students who have browsers that do not support Java;
- An interactive version – Java applets have been used for interactivity.

In the both versions, text and graphs have been combined in order to describe complex abstract concepts.

Analysis of the Interactive International Trade Program

Does the IIT program improve the learning experience of the learner? What processing demands do the graphs in the IIT program make on learners? What needs to be done to support the learner in those cases where additional processing demands are made of the learner? These are just some of the questions to be addressed in the analysis and evaluation phases of the program.

Knowledge Needed

Knowing where to look and knowing what the elements are

Key elements of the graphs in the IIT program are clearly defined. Shape, size and color have been used to clearly differentiate the key elements in the graphs. Labels have not been used extensively on the graphs and the graphs cannot "stand alone". They make sense only when considered along with the accompanying text.

Both text and graph provide complementary information – neither can stand alone. The student needs to extract the best information from each source and then mentally combine these two sets of information into one coherent set. Attempts have been made to make this as easy as possible for the student. The text and graph have been kept as close as possible. Symbols used in the graph are explained in the text thus reducing the need to cover the graph in labels.

Knowing the sequence to follow and knowing how to connect information

Reading the graph at an internal level (within the graph) is guided by two strategies: the sequential order of the graphs and accompanying text and the embedding of more detailed information in the graph to be activated when the learner has processed the information already covered.

The relative importance of information central to the theme is built up gradually by explaining successive graphs. For example, The General Equilibrium Model – Autarky (International Trade, Online) section has four graphs. The first graph lays the foundational central information required to understand successive graphs. Some of the detail of this graph is no longer required so has been removed for the second graph and more pertinent information added. This is built on in the following graph. In the fourth graph, the information built up in the previous three graphs is generalised to a similar situation.

Students need to be able to construct meaning from all the layers of information that are embedded in the graph "from the global level right down to the details" (Lowe, 1997; p. 24). This requires the flexibility, on the part of the learner, to move between levels and to develop an understanding of the inter-relationships between the different levels. The use of sequential graphs explicitly indicates the various levels in the final graph and the use of animation explicitly reveals the process represented by the graph. In this way, attempts have been made to support the development of a rich understanding of the information represented by the graphs.

In the second stage, *Trade policies and welfare analysis*, for example in *Quotas* or *Export subsidy – large economy*, the interactive buttons animate lines, points and blocks of colour. These are used to reveal the varying levels of information (axis, shape, space, meaning) thus highlighting the relations between the ideas and the area to be focused on as well as the sequence in which to read the graph. One aspect of the visual information that we are daily bombarded with is that of colour and the creator has used colour in these graphs. Colour is considered to have a profound impact on us, affecting us psychologically as well as being imbued with symbolic meaning (e.g., red for danger) (Chiazzari, 1998).

Information processing

Students need to pay attention to, or have their attention caught by, particular parts of the graph in order to develop their understanding of the subject matter. The author has capitalised on the animation capability of the online environment to direct the students' attention to the important parts of the graph and to illustrate the process that needs to be understood. Critical features have been highlighted by the use of colour and critical processes by the use of animation (see, for example, International Trade. General Equilibrium section – Autarky , Online). In the interactive version, in order to increase the instructional effectiveness of the graphics, deeper levels of visual information are activated when the learner clicks on a button embedded in the text. Arrows appear indicating the increase or decrease and a line that moves to indicate what needs to happen is activated, then disappears. This occurs automatically in the non-interactive version. In the interactive version, the learner has control over the timing of when the animation is activated and how often the animation is activated. The graph is automatically animated in the non-interactive version. This may make the material harder to process.

In Quotas – Free Trade (International Trade, Online) eight items of information are embedded in the one graph online. Would a series of graphs be more effective? Would comparing graphs side by side (possible in a print environment) be more effective than the cumulative build up that is presented in the dynamic form online? These are some of the questions that will be addressed in the evaluation of the IIT program.

Research Methodology and Data Collection

The IIT program was designed to enable students through self-paced online activities to build up their understanding of complex models associated with international trade. The program was also developed to free up lecture time for the development and clarification of key ideas and concepts. The program was not a compulsory part of their study, but the lecturer has strongly encouraged students to use it to enhance their understanding.

Some evidence of the degree to which the IIT program is successful in improving teaching and learning is being sought through the evaluation process that is currently in progress. To help ensure the evaluation design does not unduly influence the reported outcomes, a mixed approach to data production and analysis has been adopted, with both qualitative and quantitative information being obtained in the evaluation process (Reeves, 1997).

Initially, the impetus for the development of the IIT program came from the lecturer after his reflections of teaching complex economic models identified a need for a more effective approach. The inadequacy of traditional approaches (overhead transparencies in a large group lecture) and the potential offered by utilization of computer-based technology enabled the consideration of alternative methods of instruction. These initial concerns held by the lecturer are an important component of the evaluation data and were integrated into the design of the program and the implementation phase of this teaching initiative.

Information about the characteristics of the students enrolled in International Trade in first semester 2001 and their experiences using the IIT program have been obtained from two surveys. The first survey was administered early in the semester and contained questions about computer usage and access, and basic demographic details such as age and gender. The second survey was administered towards the end of semester and was a much more substantial document. In addition to repeating some of the earlier questions, the survey was designed to obtain detailed information about students' experiences using the IIT program (e.g., how often they accessed it, the ease with which they were able to navigate the site, their purpose in visiting the site). Additional data has also been obtained from a small number of structured interviews with students enrolled in the unit that semester. The content of the interviews and what questions to ask was guided by previous research (Patton, 1990). A variety of question types were asked including experience/behaviour questions, opinion/value questions, feeling questions and knowledge questions.

The evaluation process has also taken into account feedback received from other educational specialists including peers with some relevant subject knowledge and from colleagues with a multimedia or instructional design background. Data was obtained using an evaluation tool based on the work of Reeves (1997) that had been modified to suit the IIT program. This tool contained questions about both pedagogical and interface issues.

Preliminary Feedback

In the first trial of the IIT program the Students Perceptions of Teaching (SPOT) evaluations (independent student evaluation of the unit) were used to provide an initial evaluation of the program. The SPOT included two questions about the web site. In response to the question *Have you visited the web site?* 52 students responded "yes" (57%), 19 responded "no" (21%) and 20 gave no response (22%). The next question asked was *If visited, was it helpful?* 5 students responded "neutral" (10%), 18 responded "agree" (35%) and 29 students responded "strongly agree" (55%).

In the second trial (semester 1, 2001) and in response to the question *On average how often during the semester have you accessed the IIT web site?* 4 students (5%) indicated they accessed the site 2-4 times per week, 23 students (32%) accessed it weekly and a further 25 students (34%) accessed the site monthly. 20 students (27%) responded that they had not accessed the IIT web site largely because they either did not know about it or they did not see it as an integral component of the unit. Others responded they intended to use the IIT program as part of their preparation for the end of semester examinations.

The lecturer has had considerable international interest in the program and has had requests for permission to translate the material for use by non-English speaking students from other academics. He has also had commercial interest shown in the work, but is committed to making the material available as freely as possible. The lecturer has also had comments about the fact that he has not included animation (as in cartoons) or sound (music). He considers it more important at this stage to complete the program than to add in the "extras". He would like to be able to include self-checking quizzes at the end and to incorporate appropriate sound.

Conclusion

The IIT program contains very complex models, possibly the most complicated in economics. Because an online learning environment can provide the means to deliver dynamic graphs, the lecturer chose to use this format to provide his students with supplementary material to assist them in their study of these models. This paper has described the IIT program and discussed the pedagogical and technological aspects of the program. The potential demands on students' information processing ability have also been discussed. The evaluation of this program will provide further understanding of the demands such material makes on students' information processing and provide insight for the future development of similar material to support student learning.

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LEARNING OBJECTS IN DIFFERENT PEDAGOGICAL PARADIGMS

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Abstract

Based on the review of several pedagogical paradigms, this paper attempts to (i) clarify the concepts of learning resources and learning objects, (ii) propose a way forward in the use of learning resources in different pedagogical paradigms in a large scale collaborative environment, and (iii) expose characteristics required in different learning objects to match the requirements of different pedagogical paradigms.

Keywords

learning object, learning resource, pedagogical designs, learning technology standards

Introduction

The notion of small, reusable units or components in a learning environment has a lot of appeal to both educators and designers of virtual learning environments. Reigeluth and Nelson (1997) suggest that when teachers first gain access to instructional materials, they often break the materials down into their constituent parts. Teachers then reassemble or substitute for (some of) these parts in ways that support their individual instructional goals. Reusable or replaceable instructional components, or learning resources and learning objects, may provide benefits by simplifying disassembly or replacement/substitution, potentially increasing the speed and efficiency of instructional development. This paper walks through several pedagogical paradigms and attempts to identify components which may be packaged for reuse in either similar or different pedagogical designs.

The term "learning object" is used very broadly in this paper. For a more detailed analysis of terminology relating to this notion, (see Ip, Morrison & Currie, 2001; Wiley, Gibbons & Recker, 2000). Suffice it to note here that learning objects include the software mechanism to render (and support the associated user interface for interactivity) the content and enable access. In this paper, our notion of learning objects is limited to those that are used directly by a learner. The mechanism to enable multiple learning objects to coexist and interoperate with each other (learning architecture issues) is not considered here. In addition, while lesson plans and other enabling resources, such as the Educational Modelling Language (EML, 2001) or the manifest file defined within the IMS content packaging specification (Young & Riley, 2000), are educational material, we also exclude them as learning objects in our analysis here.

Pedagogical paradigms selected here do not form an exhaustive list of contemporary pedagogical frameworks. Rather, they have been selected to provide an indication of the extent of the technical issues that need to be faced as we attempt to understand the issues of reusing learning resources and learning objects in virtual learning environment design. This work may inform the formulation of specifications such as IMS content packaging (IMS, 2001), Advanced Distributed Learning (ADL) Network Shared Content Object Reference Model (ADL, 2001) and IEEE Learning Object Metadata (IEEE, 2001). Within the Australian context, this work may provide further understanding to guide the design of shareable, interoperable and reusable content for projects such as "Schools Online Curriculum Content Initiative (SOCCI)".

We will first provide an overview of the main features of, and software/systems requirements of, pedagogic approaches in use, then we will summarise these with reference to possible technical implementation requirements.

Tutorial, Drill and Practice

At one end is the rote of "drill and practice" and at the other end, a tutorial environment which provides a mechanism for presenting a problem to the online learners and provides feedback depending on the answer. When appropriately designed, the feedback mechanism can support a pre-emptive version of the Laurillard conversation model of higher learning (Laurillard, 1998)

A reusable unit may be an item (consisting, say, of the stem which is the question and responses, feedback and scoring information). The IMS Question and Testing Interoperability (IMS QTI) specification (Smythe & Shepherd, 2001) is a good candidate framework for encoding learning resources for reuse in this paradigm. The specification is designed to support question and test interoperability between different authors, publishers and other corresponding content developers.

Learning engines (Fritze & Ip, 1998; Fritze & McTigue, 1997) are a rich environment for drill and practice by allowing learners to interact with input/output and a visualisation device. The learner may respond to an item by drawing on a graphing device in addition to selecting any pre-drawn graphs. The reusable component is both the resource which determines the graph and the software component which acts as the input/output and visualisation device. Another software component, Text Analysis Object (TAO) (Kennedy, Ip, Adams, & Eizenberg, 1999; Kennedy, Ip, Eizenberg & Adams, 1998) is also a reusable unit which has special software coupled with the resource.

Case Study Method

A teaching case is a story describing, or based on, actual events, that justifies careful study and analysis by students. In other words, a teaching case is a story about the "real world" told with a definite teaching purpose in mind. A teaching case is a way of bringing the real world into a classroom so that students can "practice" on actual or realistic problems under the guidance of their teacher. Case teaching, unlike conventional lecturing, is discussion-based and experiential. The teaching case replaces the lecture as the vehicle for learning, and the case becomes the basis for discussion, exchange of ideas, knowledge and experience among participants(Lynn, 1996; Rangan, 1995).

The case study method has been practiced in the United States for many decades. It was made famous, first, by Harvard University's Business School and, later, by Harvard University's John F. Kennedy School of Government. Now cases are widely available from these two schools as well as via the World Wide Web from other sources. Obviously, the learning resources are the teaching cases together with all the discussion questions. Additional educational materials supporting the case study method normally include teaching guides associated with the cases. Proper metadata tagging will promote the discovery of appropriate cases for specific learning situation and themes.

Goal-based Learning

Goal-based scenarios (GBS) are essentially simulations in which there is a problem to resolve, or a mission to complete. They require learners to assume the main role in the resolution of the problem or the pursuit of their mission (Schank, 1997; Schank, 1990). Hence, goals in this context refer to the successful completion of the task at hand, and not the achievement of grades. Scaffolding support to the learners is available in the form of stories (commonly presented as video clips with a talking head) as told by an actor in the scenario (see Schank & Cleary, 1995). A GBS serves both to motivate learners and also provide them with the opportunity to learn by doing, by making mistakes, and receiving feedback.

The description of the scenario is obviously a resource that may be reused in other paradigm such as case study method. The major challenge in creating GBS is the just-in-time requirement of providing the learners with appropriate stories (as text or as video clips with the appropriate context). The embedding of context within video clips obviously will restrict the potential of reuse of the clip in a different context. For stories in the form of text, we will require sophisticated tagging in order for the goal-based learning system to locate relevant learning resources efficiently.

Learning by Designing

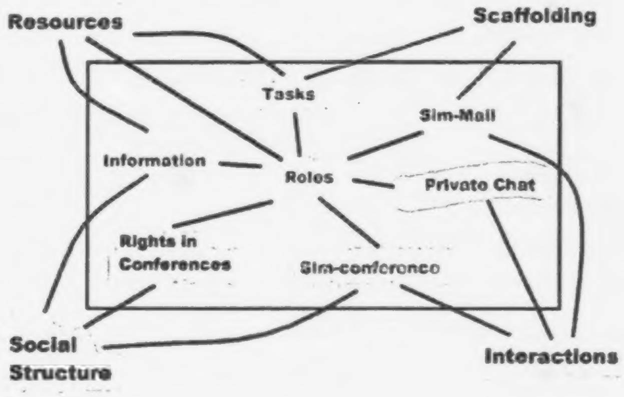
This is an educational context in which the core learning activity is the design of an artefact. Designing as a means for acquiring content knowledge is commonly used in practice-based disciplines such as engineering and architecture (Newstetter, 2000; Hmelo, Holton & Kolodner, 2000). The obvious benefit of a design task is its inherent situatedness or authenticity. In design-based learning activities, students' understanding is "enacted" through the physical process of conceptualizing and producing something.

When students are creating an artefact (digital or otherwise), the learning architecture needs to be able to track the artefacts by automatically applying either embedded or detached metadata for the artefacts. Tanimoto (2001) proposed a framework for Distributed Transcripts for Online Learning which is based on artefacts created during the learning process.

Learning objects created by the learners may still have reuse values such as acting as examples for other groups of students, or as transcript of the learning process.

Web-based Role-play Simulation

Role-play simulations are learning situations in which learners take on the role-profiles of specific characters in a contrived educational game. (Linser, Naidu & Ip, 1999). As a result of playing out roles in a role play simulation, learners are expected to acquire the intended learning outcomes as well as make learning enjoyable. While the underlying belief of web-based role play simulation is similar to goal-based scenario, it differs in both the dynamic nature of the goals as well as the mechanism in supporting learning.



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Among other things, stories or cases are used to create an authenticate scenarios. However, other resources, including real time news, play an important part in enriching the learning experience. The use of resources which are created originally not for educational consumption is an interesting issue. (Ip, Morrison, Currie & Mason, 2000) The learning architecture needs to support interchange of information among the learners, especially bi-directional communication capability raising the bar for the technology to provide collaborative and cooperative learning.

Distributed Problem-based Learning

Problem-based learning (PBL) is an instructional approach that exemplifies authentic learning and emphasises solving problems in rich contexts. It uses an instructional problem as the principle vehicle. The analysis and study of this problem comprises several phases that are spread over periods of group work and individual study (Barrows & Tamblyn, 1980; Schmidt, 1983; Evensen & Hmelo, 2000). A typical environment (e.g. Liu, Williams & Pedersen, 1999) that is based on PBL will:

1. Situate the problem in a rich context and allow learners to engage in scientific inquiries as experts do;
2. Present the problem with its complexity, yet provide tools to support students in working with complexity;
3. Provide information in multimedia formats to allow dynamic and interactive presentations that address different learning styles and student needs;
4. Provide experts' guidance from multiple perspectives to facilitate knowledge acquisition and transfer; and
5. Emphasise the interrelated nature of knowledge.

Distributed problem-based learning refers to the use of this strategy in a networked computer-supported collaborative environment where face-to-face communication among participants is not essential.

Problems are resources with specific learning objectives. However, the problem would need to be richly linked to other resources in order to create the rich context for it to have the complexity and authenticity for learners to fully engage in this paradigm. Like web-based role-play simulation, this paradigm requires collaboration support from learning architecture. Unlike web-based role play simulation, most of the current online generic conference features found in LMS will meet the need of this pedagogical design.

Critical Incident-based Computer Supported Learning

There has been growing interest in building learning environments that focus on supporting groups of learners engaged in reflection on critical incidents from their workplace (Wilson, 1996). Reports of knowledge sharing during the afternoon tea-break conversation of a group of maintenance technicians, supports the effectiveness of sharing of experiences. During these informal causal conversations, these technicians shared their "war stories" about how they solved problems daily. In the casual and friendly environment over the afternoon tea, the third-person experience, as told in first person, quickly transformed into the repertoire of the listeners. This gives rise to the premise that there is much potential for the storyteller for supporting learning.

A critical incident (from the workplace) presents a learner with a learning opportunity to reflect in and on action. Learners can do this by keeping learning logs which is a record of learning opportunities presented. The critical attribute of the learning log is that it concentrates on the process of learning. It is not a diary of events nor is it a record of work undertaken, rather it is a personal record of the occasions when learning occurred or could have occurred. The learning log also relates prior learning to current practice and is retrospective and reactive in action.

The learning architecture needs to support distributed management of learning logs. Most computer supported collaboration environment would be sufficient to support this type of learning.

The resource created during this process, i.e. the learning log, has some reuse value in the form of experiences of how other workers approach their learning in similar situation.

Rule-based Simulation

Rule-based computer simulations (RBS) are educational programs that model real systems. The learner's basic actions are to change the values of some input variables and observe the resulting changes in the values of output variables (de Jong & Joolingen, 1996). Rule-based systems are either conceptual or operational models (van Berkum & de Jong, 1991). Conceptual models contain principles, concepts, and facts related to the (class of) system(s) being simulated. Operational models include sequences of cognitive and/or non-cognitive operations (procedures) that can be applied to the (class of) simulated system(s). Examples of conceptual models can be found in economics (Shute & Glaser, 1990) or in physics e.g., electrical circuits, (White & Frederiksen, 1989; 1990). Operational models can be further divided into models where timing of actions is not relevant e.g., troubleshooting of avionics, (Lesgold, Lajoie, Bunzo, & Eggan, 1992), or troubleshooting of complex devices, (Towne et. al., 1990), or where timing is critical e.g., radar control, (Munro, Fehling, & Towne, 1985), or flight simulation. In many cases, real operational proficiency includes knowledge of an associated conceptual model (de Jong, Swaak, Scott & Brough, 1995, August; Kieras & Bovair, 1984). For example, operational knowledge on fault diagnosis can be related to conceptual knowledge of the device that is to be diagnosed. The value of RBS is the opportunity provided to the learners to try out different scenario in a safe and economical environment.

Microworlds, or computer simulations of restricted environments are a form of rule-based computer simulation. They are an intuitively appealing way to promote discovery and exploratory learning. Papert (1980) called computer supported microworlds "incubators for knowledge" when he described the potential of computer aided learning to encourage exploration and thus self-education by children. His educational philosophies stem from Piaget's work on learning which, simplistically, state that much of children's learning occurs without being taught: children construct their skills and understanding from seeds of knowledge.

Creation of digital microworld for simulation and learning may be one of the most challenging and creative aspects of designing learning objects and learning architecture. Learning objects in this paradigm will be active software component (agent) which interacts with other components in the microworld to model the environment. Efforts in creating interoperability components for use in this environment include (Ip & Canale, 1996; AgentSheets, Online; E-slate, 2000) and (ESCOT, 2001)

Exploratory Learning

Exploratory uses of instructional technology allow students to direct their own learning. Through the process of discovery, or guided discovery, the student learns facts, concepts, and procedures. (Department of Education USA, 1993) The pedagogical underpinning is closely related to rule-based simulation. The difference is the focus of the exploration. In rule-based simulation, the exploration is a simulator and the challenge is the creation of the simulation. For exploratory learning, the focus is on information or resources and the challenge is effective resource discovery while protecting minors from indecent or otherwise inappropriate material.

In traditional learning environments, the information available to learners (e.g. children in school) have been carefully selected, edited or reworked to meet both the "duty of care" and the learning profiles of the learners. (The school library plays an important role in the selection process.)

However, with the advent of the communication network, resources, including those not originally intended for educational consumption may be available to learners during exploratory learning. Ip et al. (2000) and Ip and Naidu (2001) highlighted the need to rethink the issues of availability of materials for educational use.

Cognitive Tool

Reeves (1999) suggests two major approaches to using interactive learning systems and programs in education.

First, people can learn "from" interactive learning systems and programs, and second, they can learn "with" interactive learning tools. Learning "from" interactive learning systems is often referred to in terms such as computer-based instruction or integrated learning systems (ILS). Learning "with" interactive software programs, on the other hand, is referred to in terms such as cognitive tools (Lajoie, 1993; Jonassen & Reeves, 1996) and constructivist learning environments. With the use of such "cognitive tools", learners can enter an intellectual partnership with the computer in order to access and interpret information, and organise personal knowledge. Computer-based cognitive tools have been intentionally adapted or developed to function as intellectual partners to enable and facilitate critical thinking and higher order learning.

Typical cognitive tools include databases, spreadsheets, semantic networks, expert systems, concept maps, communications software such as teleconferencing programs, on-line collaborative knowledge construction environments, multimedia/hypermedia construction software, and computer programming languages.

Learning objects need to be software which support learning. TAO (Kennedy et al., 1999; Kennedy et al., 1998) doubles as a cognitive tool as well.

Resource-based Learning Environment

Resource-based Learning Environment (RBLE) emphasises a transformation of meaning through learner-centred, system-facilitated action. RBLEs support and extend efforts to know, understand, and generate, that is, to reflect, construct, solve problems, and integrate new information for one's own purposes (e.g., curiosity, dissonance) as well as for others' purposes e.g., research topic, gain varied perspectives on an issue, solve an assigned problem (Land & Hannafin, 1996). They provide not only comprehensive collections of highly indexed data, information, and search engines, they help learners to reason, reflect, and assess the veracity of the systems' contents.

Traditionally, special collections of resources in libraries will provide the starting basic of RBLEs. Obviously, indexing and providing efficient discovery of learning resource are of prime importance in this environment.

Summary

Pedagogical Design	**Nature of the resources**	**Need special rendering software**	**Resources are specifically designed for educational use**
Tutorial, Drill and Practice	Test or drill items, (may be structured to meet interoperability standards such as IMS QTI)	Yes – directly or indirectly Some learning objects may have embedded content and some may not.	Yes
Case Study Method	Teaching cases	No – cases are normally hardcopy but online cases can include video – but hard-wired to the learning scenario (see GBL)	Yes
Goal-based learning	Stories, or video clips, provided mainly'on-demand'	No	Yes
Learning by designing	The requirement for an artifact	No	Yes

Pedagogical Design	**Nature of the resources**	**Need special rendering software**	**Resources are specifically designed for educational use**
Web-based role-play simulation	A scenario & associated design of the role play simulation resources	No, but the environment itself may be a specialist engine (Ip & Linser, 1999)	Scenario etc: yes Resources: no
Distributed problem-based learning	Problem for solving during the learning	No	Yes
Critical incident-based computer supported learning	Opportunities for learning – incidence	No	No
Rule-based simulation	Embedded in the software	Yes, most component-based approaches to creating rule-based simulation will have embedded content in the components which roughly map to learning objects in this paper	Yes
Cognitive tool	Structured content to work with some tools, generic tools may not need any content	N/A	N/A
Resource-based Learning Environment	Resources	Search tool and resource discovery mechanism, e.g. in the form of support from subject gateways	No

Table 1: Use of resources in different pedagogical design

Implication For Understanding Learning Objects And Learning Resources

We use a diverse range of resources in our practice of teaching and learning. In summary there are:

- specifically written up reading material (case method, problems in problem-based learning) - learning resources
- reading resources originally created for other purposes (web-based role play simulation, exploratory learning, resource-based learning) - we refer to these type of resources as NEF resources, (see Ip et al., 2000; Ip & Naidu, 2001).
- multimedia resources in order to convey authentic situation and a sense of authority (video clips in goal base learning) - multimedia learning resources requiring generic software to render (such as QuickTime player)
- structured resources designed to be used in an interactive way (items in tutorial, drill and practice) - structured learning resources requiring the service of specialised learning objects. Some learning objects may have the content embedded in a way that further separation of the rendering mechanism and content is impossible and
- specialised software agents with embedded content and context (as in component-based rule-based simulation).

We also use a diverse range of software components and/or systems such as:-

- cognitive tools,
- collaboration systems to support the generic communication,
- specialised system as in web-based role play simulation, and
- rule-based simulation.

Some of these software components work with structured content (TAO as a cognitive tool and learning engine).

In other words, learning resources (both text and multimedia) include both resources specifically created, selected and edited for learners and NEF resources drawn from other sources.

The former resource may not be structured. These resources can be rendered by generic device (such as text viewer or web browser). There are structured learning resources (such as those created conforming to IMS QTI specification (Smythe & Shepherd, 2001) which need to be rendered by special matching software in order to be used effectively in an educational context.

Some educational software renders several structured educational resources of the same type, other will have the educational content embedded (such as the Java Applets submitted to Educational Object Economy (EOE, 2000).

In object-oriented software design, a software component has role, interface, attributes and actions in order for different software objects to work together as a whole system. A learning object may have

- Attributes in the form of the resources that go with the object. For example a rendering to provide selection in question and testing, the rendering software is the Q&T object and the items defined in IMS QTI is the acceptable attribute to this object
- Behaviour in order to allow other learning object to interact e.g. for provide rule-based simulation
- Interface for activation.

The creation of the learning object (as software supporting assembly, interactivity and behaviour) and the content (as attribute) demand different skills. The former calls for expertise in software development and the latter requires subject matter expertise. In looking at each pedagogical paradigm, we can see a separation of the content elements (text, graphics, referenced sources, etc), the means of packaging/assembly of these and the means of supporting interactivity (with students, CMS and LMS) and open access. The separation of the content data, from the packaging and communication (access and interaction) is an important one that current emerging technologies such as XML/DataBinding and XML transformation languages (XSLT) are beginning to enable. This proper clarification of roles of the developer (software development, pedagogical design and subject matter creation) (Ip, 1997) will be a welcome approach to efficiently create engaging educational courseware.

The embracing of the 'digital agenda' by an individual educational institution is an expensive proposition and it is important to leverage as far as possible through re-purposing and re-use the learning resources. It is also important where means of capturing sound pedagogies into a technical vehicle are possible that these too foster re-purposing and re-use. Learning objects, being an encapsulation of both the rendering software and the subject matter content, represents a potential unit of multiple deployments in different situations. However, there is a difference between learning objects and learning resources, the latter implies content, the former implies addition of the (technical) vehicle to afford encapsulation, support interactivity and manage access. (Here learning resource is naively defined as just the resource) Understanding of this difference is a first step towards a re-use framework to control the cost of the digital agenda.

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OPPORTUNITIES LOST: RESISTANCE TO COLLABORATION IN THE NEW ZEALAND K-12 TEACHING COMMUNITY

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Abstract

In the light of recent NZ government initiatives designed to increase occupational networking amongst K-12 teachers, this paper examines the potential of the Internet to meet this objective. The paper then investigates why teachers might ignore or avoid opportunities to form and benefit from weak ties online, despite claiming to regard such networking as professionally valuable. Finally, recommendations are made regarding the type of incentives and initiatives likely to encourage electronic weak tie formation within K-12 environments.

Keywords
online collaboration, weak tie networks, educational community

Introduction

Weak interpersonal ties are those connecting individuals who do not share relationships with a common set of people (Granovetter 1973). The value of weak ties is that they provide an individual with information that is not shared within his/her regular social or professional circle, and in this way they broaden his/her knowledge base, foster community (Adelman, Parks & Albrecht, 1987; Walther & Boyd, 2000), and introduce different perspectives and new opportunities (Haythornthwaite 2001; Harasim, Hiltz, Teles & Turoff, 1995). In so doing, weak ties prevent members of regular professional, social or organizational groups from becoming insular and limiting themselves to resources circulating only within the network to which they belong (Pickering & King, 1999; Garton, Haythornthwaite & Wellman, 1997; Burt, 1992).

It has been noted (Pickering & King 1999; Haythornthwaite 2001, Hiltz & Turoff 1993; Garton et al., 1997) that weak ties are particularly prevalent in 'occupational communities' (Van Maanen & Marley, 1984) that is, communities that engage in professional work the norms of which transcend the norms of the organization that employs them. The academic community is unfailingly cited as an example of such a community; however, while this may be true of educators in the tertiary sector, the occurrence of weak tie formation in the K-12 sector is open to question. There has also been little research into why educators might resist or avoid forming weak ties, given increased opportunities to do so online.

Consequently, this paper examines, firstly, the perceived importance of weak ties in the school teaching sector; secondly, the extent to which teachers avail themselves of weak ties online; and finally, the reasons behind online opportunities being either welcomed, ignored or resisted.

Method

Information for this study was gathered both quantitatively and qualitatively, by means of:

- a questionnaire distributed to six schools located in the Greater Auckland region of New Zealand: two rural, four suburban. The student populations of the schools range from 50 to 1500, while teaching staff at each school number between three and 94). The questionnaire identified (1) whether and how frequently teaching staff use weak ties in the pursuit of their teaching/ professional responsibilities and development, and (2) whether and to what extent the internet was used to activate or maintain weak ties.

- follow-up interviews with 18 teachers, during which they were invited to discuss their perception of themselves as members of a wider occupational community and, where this perception exists, to discuss the means by which their sense of community is communicated and reinforced.
- individual interviews with the school principals, to elicit their opinions regarding the importance of teachers networking outside the school's immediate community, and the extent to which deliberate provision is made (both on and off-line) for this networking to occur.
- analysis of 26 national 'teaching community' websites and 4 government education websites.

All the schools provide staff with unrestricted access to computers (with Internet access), free email accounts and unlimited access to the Web.

Results and Discussion

Perceived Importance of Weak Ties in the K-12 Sector

The Government Perspective

In 1998 the New Zealand government established "Te Kete Ipurangi", an educational web portal with the following goals specifically reflecting the value attached by the government to weak tie formation between school teachers in New Zealand:

- furthering a global online education community,
- delivering a clear path to quality online information, services and resources to meet a diverse range of school needs, and
- establishing a community of learners, who are sharing information.

Apart from providing reports on current topics in education and links to teaching resources, the site includes a discussion forum and a message board, and offers opportunities for subscribing to on-line newsletters and distribution lists. These features show an active commitment to weak tie formation within the K-12 teaching community.

In addition, a government-funded 'ICT Professional Development in Schools' campaign was launched in 1998, encouraging schools to combine resources in order to promote the incorporation of Information Technology into curriculum development. This 'cluster schools' campaign, although primarily aimed at efficiency and cost-effectiveness, also supports the concept of teaching staff creating and maintaining networks outside their immediate school confines.

The School Perspective

Overwhelmingly, the Principals and teaching staff subscribed, both in interviews and in informal conversations, to the view that teachers were part of a larger occupational community, and that they would be advantaged by increased exposure to a variety of perspectives through networking with colleagues. However, a disparity emerged in that - despite the effort and resources being invested by government into creating a framework for online weak tie formation - survey results also revealed that the majority (92%) of teacher respondents believed their information needs to be sufficiently met within their close professional circle (frequently a department within a school, or else within the school itself). Reasons for this disparity are suggested later in this paper.

How Necessary is the Internet for Communication Between Weak Ties?

Both questionnaires and interviews identified the Internet as the most practical medium for weak tie communication. While the telephone rated highly, email had the perceived advantage of being asynchronous, and of making it easier to contact virtual strangers. Distribution lists were also more popular amongst respondents than discussion groups, requiring no additional effort to access.

Off-line channels for forming weak ties were identified as conferences, Teachers' Association meetings, as well as – in the case of 'cluster' schools – combined instruction sessions in the use of information technology in the curriculum. For the majority of teachers, in other words, opportunities for forming weak ties off-line are relatively infrequent.

Extent to which Opportunities for Forming Electronic Weak Ties are being Taken Up

In contrast to the paucity of off-line opportunities for weak tie networking, NZ schools are well provided with means for allowing this type of communication to occur electronically. Over the past four years schools have dramatically increased in ICT awareness, to the point where – due partly to government subsidization of network cabling and infrastructure - it is standard for schools to have Internet connectivity and to provide access to computers for both staff and students.

Nevertheless, only 6.25% of teaching staff consulted in this study actually used these resources to form ties with members of an 'education community', be it for information or to discuss issues of mutual concern. (The 6.25% was composed mainly of staff actively engaged in research or distance study, and staff teaching in Careers or in Information Technology departments.)

Accounting for the Disparity: Factors Leading to these Online Opportunities being Ignored or Resisted.

Overall, interviewees welcomed opportunities for Internet-based networking, despite evidence suggesting that few are actually taking advantage of this. Reasons suggested by teachers themselves as to why these opportunities are not taken up, were:

- Limitations of time;
- Computer use not an integral part of daily routine;
- The perception that 'we do things differently', with teachers encouraged to find solutions within their immediate school culture, often as a matter of pride. This perception also emerged regarding the relevance of networking in international forums.
- The perception that 'surfing the net' is an activity engaged in by pupils rather than by teachers whose time for frivolous recreation is limited.

Additional reasons suggested by this study are:

- Although involvement in research or professional development emerged as a predictor of weak tie formation amongst the teachers surveyed, few teachers questioned (4%) were actively engaged in research or further study, and there are few incentives for them to do so.
- In the case of 'cluster' schools, activities to date have centred on up-skilling teachers in basic use of the Internet and other available information technology, and it is possible that they are not yet confident enough to incorporate the new networking opportunities into their professional routines.
- Few models for participating in weak tie networks seem available; for example, even the online versions of the NZ Education Gazette and the site for the New Zealand Teachers' Association have no areas for sharing or debating ideas. Even where there is a perceived need for national curriculum based 'resource sharing' amongst NZ educational communities, this largely takes the form of links to sites where information can be found, with little or no opportunity provided for weak tie 'visitors' to discuss or share ideas regarding the information being accessed.

Thus, despite a generally-stated need by K-12 teachers and principals, and despite many millions of government dollars being invested in their success, current measures are not yet succeeding in encouraging weak ties amongst those at the chalk face in the K-12 sector.

What would it Require?

If current measures are insufficient, what further steps could Government, as well as schools themselves, be taking to encourage electronic networking amongst teachers?

- If the aim to encourage 'a global community' of teachers sharing ideas and resources is a serious one, then education of teachers in the uses of the Internet and provision of necessary hard and software are essential but insufficient means to that end. However, since virtual cross-pollination of ideas can prove disruptive of tradition and routine, there is a tendency for educators to pay lip service to the concept, while blocking practical expressions of it. Similarly, while schools still compete at almost every level academically and in the sporting arena, a culture of genuine sharing is a difficult one to establish.
- A further challenge lies in up-skilling teachers who will then be encouraged to *use* those skills – in other words, both school management and teaching staff need to be prepared to make - or

rather *require* - changes to the status quo. This commitment could be practically demonstrated by School Boards requiring the inclusion of ICT components in teaching schemes.

- Furthermore, the principle of 'clustering' schools, at present a fairly superficial economic process of sharing training events and educational resources, should be extended to sharing risks and research in the form of, for example, pilot studies in virtual team teaching.
- Viable channels and rewards are essential as encouragement for schools forming international virtual partnerships with K12 providers – not merely as an social studies exercise for pupils, but specifically to promote *and try out* fresh approaches to common pedagogical issues, as well as joint research and professional development of teaching staff. Both government and school boards of trustees would need to recognize and provide resources (including time allocations) for the professional development of staff engaging in joint study ventures and research with teachers and educators in other countries.
- Lastly, although models of effective networking do not as yet exist in the NZ schools' context, the existing online infrastructure could be easily developed to allow for this. Government sites such as the Education Gazette, as well as those of responsible bodies such as the Teachers' Association, could model meaningful use of discussion forums and offer a support and advice service to schools wishing to initiate discussion forums of their own.

In short, the need is to encourage a mind-set, in both school management and teaching staff, that not only acknowledges the value of expertise and ideas that reside outside strong-tie networks, but also practically creates channels and opportunities for initiating and being changed by them. Until both these criteria are met, money thrown at creating virtual opportunities for weak tie networking will continue to fall on fallow ground.

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EXTREME PROGRAMMING REQUIRES EXTREMELY EFFECTIVE COMMUNICATION: TEACHING EFFECTIVE COMMUNICATION SKILLS TO STUDENTS IN AN IT DEGREE

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Abstract

The ability to communicate effectively is an important skill for IT graduates, particularly in light of the increasing acceptance and success of Extreme Programming methods. This paper describes an effective communication module taught as part of a subject focused on Extreme Programming. An assessment of students' perceptions of effective communication and their attitudes to the pedagogical techniques employed was undertaken. Specifically, students seem aware of the value of effective communication and felt that role-play activities, discussion, small-group activities and lectures contributed the most to their learning. Consideration of student opinions provides insight into how the course can be improved and offers some guidance to other academics wishing to incorporate communication-skills modules into IT courses.

Keywords

effective communication, teaching techniques, extreme programming

Introduction

It is increasingly recognised that the curricula of computer science and IT degrees often focus on technical content, ignoring or deprioritising the importance of teaching effective communication skills (Fornaro, 2000; McGinnes, 1994). Yet, IT professionals are expected to be able to communicate proficiently with users, clients, management and indeed, each other. Research has shown that teamwork skills (including the ability to communicate effectively) facilitate an increase in quality of output and productivity in the IT industry (Fornaro, 2000). It cannot be assumed that IT graduates will learn to communicate effectively on the job (McGinnes, 1994). Thus, teaching undergraduate IT students to communicate effectively is an essential part of preparing them to be successful in a work environment.

Recently, the value of effective communication skills in the IT industry has been highlighted by the increasing acceptance and success of a software development methodology called Extreme Programming (XP) (Beck, 2000). Extreme Programming is characterised by pair programming (all production code is written by two people at one computer), rapid development iterations and releases, on-site customer involvement, a "test-first" approach to development, collective ownership of all code and an open team-room workspace. Unlike traditional software development methodologies in which solo programmers can be found, team involvement is crucial in Extreme Programming. Team members support each other, learn from each other and feed creatively off each other.

Another difference between traditional software methodologies and Extreme Programming is the style of communication. Traditional software development approaches are characterised by paper communication: each development phase typically concludes with the production of a document (e.g. requirements specification, design documents, etc.). Extreme Programming, on the other hand, is based on human communication. It is important for software developers who employ Extreme Programming techniques to be able to keep each other informed, resolve issues as they arise, interact productively with customers and generally communicate effectively.

Information Environments Program

The Bachelor of Information Environments (BInfEnv) degree is a design-focused, studio-based information technology degree. The degree augments the core courses from The University of Queensland's standard IT degree with a stream of design courses and integrative studio-based projects undertaken every semester. The studio projects integrate and reinforce learning by requiring students to apply the knowledge and skills gained in other courses to open-ended real-world design projects. The studio model is based on the architectural studio and involves teamwork, collaborative learning, interactive problem solving, presentations, and peer review.

In order to familiarise Bachelor of Information Environments students with Extreme Programming, the XP methodology was introduced into the curriculum in 2000. In 2001 the subject in which Extreme Programming is taught was revamped to include a module on communication skills. It was considered important to incorporate communication skills into the curriculum not only because of the role they play in Extreme Programming, but also because the ability to communicate effectively is a valuable skill in the vast majority of workplaces. To this end, a number of students had reported difficulties with working in groups (through personal communication with staff and feedback via web pages and subject evaluation forms), moreover, it had become apparent, from observation in class and personal interactions, that many students had difficulty expressing concerns and resolving conflict with their peers.

Effective Communication Module

The effective communication module was taught during the first four weeks of semester, prior to an eight-week module focused on the Extreme Programming methodology. The communication module was based on the work of Wellen and Noller (unpublished) and consisted of five teaching blocks that were based on 5 different skills: effective listening, disclosure, assertion, anger management and problem solving. Effective listening involved improving student's understanding of each other's communications and being able to show and clarify that understanding verbally and non-verbally. Disclosure incorporated both the ability to recognise the legitimacy of one's concerns, and also being able to express those concerns in a non-blaming, constructive manner. Assertion involved helping students to recognise assertive, aggressive and non-assertive behaviour in themselves and others, and to understand the benefits of assertive behaviour. Anger management involved familiarising students with coping strategies that prevent expressing anger in indirect or hurtful ways, showing students how to deal with feelings of anger when they arise, and finding effective and constructive methods of expressing anger. Finally, the problem solving teaching block aimed to help students distinguish collusive, competitive and cooperative problem solving behaviours and provide them with a methodology for effective cooperative problem solving.

Pedagogical Techniques

Effective communication skills are different in many ways to the other skills students are taught in an IT degree. Moreover, it is possible that some IT students might perceive communication skills as less relevant to their careers than other more technical skills. Given the uniqueness of the skill-set being presented to the students and the potential resistance to the content, the staff developing and teaching the communication module were motivated to find the most effective teaching techniques and to assess students' perceptions of both the content of the classes and the pedagogical techniques employed.

Very little research has investigated teaching and learning communication skills within IT degrees. However, research, conducted with students of other disciplines, has shown that small groups provide a relatively safe environment in which students can explore and practice communication skills (Hudson, Doyle & Venezia, 1991) and that role-playing often helps students understand and develop effective communication techniques (Costanzo, 1992; Hudson, Doyle & Venezia, 1991). Based on these findings, small group activities and role-play were incorporated into the communication module. In the interest of exploring the utility of a variety of methods, a number of other teaching techniques were also used (lectures, discussion, personal reflection, group reports, and feedback from staff and students).

Method

A questionnaire was used to assess students' perceptions of effective communication skills generally and also the relative merit of the various teaching techniques employed. The questionnaire was delivered to students in class time two weeks after the conclusion of the effective communication module. The questionnaire included both qualitative open-ended questions that assessed how students felt the communication module could be improved and over what time frame the course should be taught, and quantitative questions (7 point Likert scales, 1 'not at all' to 7 'very much') which assessed the extent to which students had experienced communication problems during group work, how valuable and important communication skills are, how enjoyable and helpful the various learning techniques were, and how important the five specific communication skills covered in the module are in a group work environment. Twenty-eight male and five female students (approximately 80% of the class) voluntarily completed the questionnaire. Participants ranged in age from 18 to 39 years with an average age of 21.8 years.

Results

The results were originally analysed using inferential techniques. The statistically significant findings using inferential techniques were largely identical to the conclusions that can be drawn from descriptive statistics. Given the small sample size and the relative simplicity of the analyses undertaken only descriptive results are reported in this paper.

Perceptions of Communication Skills

The majority of students indicated that they had experienced communication problems during previous group work (mean=4.66, SD=1.33). On average students perceived communication skills to be valuable (mean=5.48, SD=0.87) and important (mean=5.55, SD=0.87). Specifically, students felt that problem solving (mean=5.97, SD=0.95), effective listening (mean=5.88, SD=0.82) and anger management (mean=5.76, SD=1.03) were relatively important skills, whereas assertion was perceived to be slightly less important (mean=5.42, SD=1.03) and disclosure was perceived to be of least importance (mean=4.97, SD=1.21).

Perceptions of Teaching Methods

On average, students perceived discussion (mean=5.42, SD=1.06), lectures (mean=5.33, SD=1.16), role-play (mean=5.33, SD=1.05), small group activities (mean=5.3, SD=0.77) and personal reflection (mean=5.28, SD=0.92) as contributing more to their learning than group reports (mean=5.06, SD=0.88), feedback from staff (mean=4.91, SD=1.1) or feedback from students (mean=4.48, SD=1.35). With respect to student's enjoyment of teaching methods, role-play (mean=5.24, SD=1.28), discussion (mean=5.19,SD=1.15) and small group activities (mean=5.09, SD=0.91) were on average, more popular than feedback from staff (mean=4.85, SD=1.23), group reports (mean=4.79, SD=1.11), lectures (mean=4.7, SD=1.24), personal reflection (mean=4.69, SD=0.93) or feedback from students (mean=4.67, SD=1.05). In terms of their relative understanding of the five content areas taught, students on average perceived themselves as grasping effective listening (mean=5.75, SD=0.8) very well, anger management (mean=5.47, SD=1.14), problem solving (mean=5.47, SD=0.92) and assertion (mean=5.34, SD=0.79) fairly well, and disclosure least well (mean=4.97, SD=1.15).

Qualitative analysis revealed that the majority of students (78.1%) felt that weekly classes distributed over a four week period was the most preferable delivery method, 12.5% of students indicated a preference for a more concentrated block of teaching (two or three days) and the remaining 10% of students indicated a preference for other alternatives. In terms of how the communication skills module could be improved, the most common suggestions were to include more practical examples of skills and to incorporate more role-play activities.

Discussion

Effective Communication Skills

Overall, there is good support for teaching communication skills within an IT degree. Not only are communication skills important as a skill for Extreme Programming but also students indicated having experienced a moderate degree of difficulty working in groups that could largely be mediated by the introduction of more effective communication. Moreover, students seem to recognise the value and importance of effective communication.

It is interesting to note that students perceived disclosure as less important in a group environment than the other skills taught in the module. This is potentially concerning as disclosure is a skill designed to facilitate the expression of one's own concerns and problems which is essential in a group work environment. The fact that students indicated disclosure to be the least well-understood skill suggests that slightly more effort may be needed on the part of teaching staff to explain the concept of effective disclosure and its role as a part of effective communication. Although replication and generalisation are needed, this may also indicate that disclosure is a slightly harder concept for some students to grasp.

Teaching Techniques

The teaching techniques that students seemed to most enjoy were role-play, discussion and group work. Students' enjoyment of these techniques is a recommendation for their inclusion in effective communication lessons. This recommendation is strengthened by research that suggests that these techniques contribute to learning (Costanzo, 1992; Hudson, Doyle & Venezia, 1991), by the students' own perceptions of the contribution these techniques made to their understanding, and by the suggestion by some students that the course could be improved by more role play. Conversely, students felt that reports from other groups and feedback from their peers contributed a great deal less to their learning. This opens up the possibility that less focus should be placed on these techniques in class. However, the measures taken in the present study assess students' perception of how much they learnt from the reports and feedback of others. These measures do not assess the value for students of reporting their own ideas back to the class or being challenged to consider the ideas of others. Hence, further research is required to adequately assess the pedagogical value of these techniques.

Conclusions and Future Research

The present study suggests that students in the Information Environments degree are relatively aware of the importance of communication skills and that they value certain teaching techniques over others. Before these findings can be confidently extended to IT students generally, further replication and generalisation of the results is required. Moreover, the present study focused on student's subjective attitudes and beliefs. Future research will be directed firstly, at more objective assessments of the extent to which students in the Information Environments degree acquire the effective communication skills taught and secondly, at assessing the extent and manner of student use of effective communication skills during Extreme Programming tasks.

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RIVERBEND @ WEBCT: INNOVATIVE REUSE OF EXISTING TECHNOLOGICAL RESOURCES FOR PROBLEM-BASED LEARNING IN PROFESSIONAL EDUCATION

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Abstract

This paper describes the way in which the capabilities of WebCT are being extended to enhance a Problem Based Learning (PBL) course in the professional education of behavioural scientists. It is argued that the tool meets all the criteria for PBL courses and makes appropriate use of the potentialities of web-based tools. Since it uses an existing platform already in use it was cheap to develop and relatively familiar to the students. The site portrays a town we have called Riverbend and it aims to provide a real-world feel for the PBL experience. It is to be developed further by other lecturers for use in more courses and in one course the students themselves will build model enterprises in Riverbend.

Keywords

problem based learning, multimedia, re-using technology

The Course and its Challenges

The Behavioural Studies Program provides students with an interdisciplinary approach to understanding and intervening in social contexts and individual behaviour. The program includes a course called *The Professional Self*, which focuses explicitly on professional practice. Universities are sometimes criticised for giving students too much theoretical (or declarative) knowledge, and not enough practical knowledge. In fact, of course, the successful practitioner needs both and in our view the best way to achieve this integration is through the use of Problem Based Learning techniques.

The Problem Based Learning (PBL) Approach

While PBL is agreed to cover less content than conventional modes (Biggs, 1999) it is acknowledged to be the pedagogy of choice where particular attention is being paid to active, deep learning (Biggs, 1999), particularly in professional training (Boud & Feletti, 1991; Cowdroy, 1994). For the social scientist the PBL approach allows students to be exposed to descriptions of life-like situations in all their ill-defined complexity, without exposing them or the studied populations to harm. While one of the basic tenets of PBL is that learning and recall is improved by learning in a situation as near to the real life one as possible (Schmidt, 1983), the teacher's ability to provide this is obviously limited by having to present situations as text. This can be alleviated to some degree by varying the presentation with videos and other such devices and in recent years attention has turned to the use of electronic media. Several examples now exist of CD-ROMs and web-based materials which use the visual potentialities of such media and their ability to deliver text, audio and video to enrich the PBL experience. Many of the electronic versions of PBL are aimed at remote students and the group experience is supposed to be provided by electronic communicative tools (Jolly, 1997). But electronic formats have other advantages and these can be obtained through the adaptation of existing tools rather than expensive and time-consuming building of new ones.

Adapting WebCT

Our original plans were for a web site which would represent a town in which students would discover and explore problems in professional practice. Graphics at various levels of navigation and addition of audio and video materials would increase the real-world feel of the site. The expense of such a construction meant we had to think laterally about our existing platform, WebCT. Happily, this has allowed us to meet most of our goals. The following graphic illustrates the home page for the course:

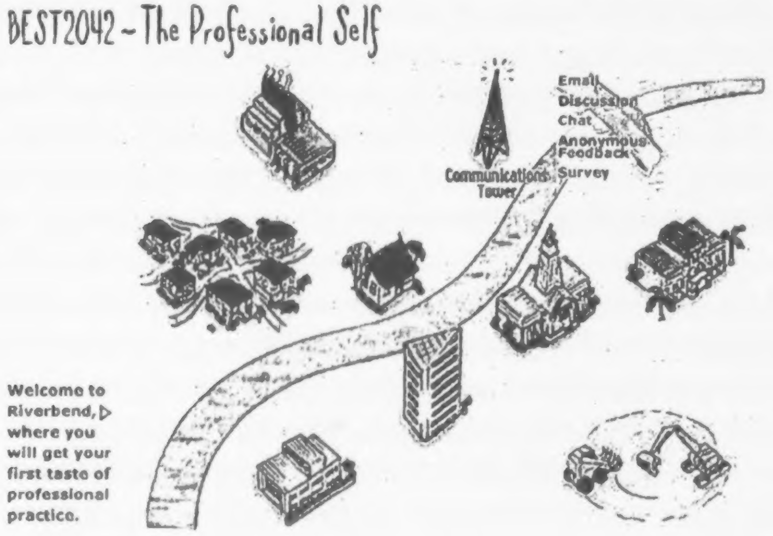
BEST2042 - The Professional Self
Email
Discussion
Chat
Anonymous Feedback
Survey
Communications Tower
Welcome to Riverbend, ▷ where you will get your first taste of professional practice.

Figure 1: The Riverbend home page

Visitors to the BEST2042 WebCT site are not greeted by the usual row of buttons but by the kind of map you might see on a tourist brochure, with sketch drawings of major sites such as the Council Chambers. Each illustrated site leads students to the kind of resources one would expect to find there in the real world. So the Council site provides statistics about the town, descriptions of civic initiatives and access to real sites belonging to comparable cities. Thus students are led from the invented situation into real ones. The scenario that prompts students' work in Riverbend concerns problems surrounding the re-organisation of the pulp and paper mill belonging to the major local employer, Byrd Industries. They work in teams of five or six as consultants for Andrews & Sullivan to identify and suggest strategies for dealing with the situation as it develops over the semester. The "New Developments" part of the site allowed us to make use of opportunities that arose during semester, such as a relevant debate on the ABC's web pages, to add more material and increase the relevance of the site.

One very useful resource which could not be provided in any other medium, is the ability to have sound files on WebCT. Our students have to choose between three oral presentation tasks - a debate, an interview and a presentation to the board. Although they are given readings and criteria, and we talk to them about what is required, it is useful to have sound bites demonstrating what they are expected to do. So there is a recorded interview on the newspaper's pages, a debate under the Council and a presentation to the board on the Byrd pages. These were all specially written to fit into the Riverbend scenario and to meet the criteria that students will be assessed by. Further development of the site will incorporate video prompts (such as surveillance video footage for a course in crime prevention). In a third year course in our World of Work concentration students will be required to build their own model enterprises in Riverbend, taking due notice of what already exists on the site.

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The Educational Rationale

As Albion (2000) points out, it is necessary to demonstrate that such tools in fact provide a PBL experience, especially if, as here, one is aiming for the full benefits of an iterative style of PBL. Albion (2000) takes the following nine points as definitive of PBL:

1.	The materials present a problem as the starting point for learning
2.	The problems presented in the materials are relevant to the future professional lives of [the students] and provide a meaningful context for [the topic of the course]
3.	Materials of this type could be used in a sustained educational approach and not simply as an atypical insertion in an otherwise conventional educational experience
4.	The materials are consistent with an approach in which learners assume significant responsibility for their own learning
5.	The materials encourage learners to become active processors of information
6.	The materials provide opportunities for learners to activate prior relevant knowledge
7.	The materials provide opportunities for learners to elaborate and organise their knowledge
8.	The materials are consistent with an approach in which knowledge is organised around problems rather than disciplines
9.	The materials are consistent with the experience of learning in small groups rather than through lectures.

Table 1: Requirements of the PBL method (from Albion 2000)

I have already described the use of problems, which evolve over time in response to student interest, to drive learning. Early responses from students indicate that they find these problems relevant and engaging and that Riverbend is a meaningful context for their work. When asked to rate the usefulness of various support mechanisms provided in this course, the students we have heard from so far rate the library above the web site, which encourages us to think that the site stimulates them to seek out further knowledge (the on-site survey has not been completed by all students at time of writing). The articulation of the problems require them to work in small groups and we have seen students follow their bent towards various disciplinary approaches and draw on past experience quite significantly. It should be noted that the site is supported by small group work in class. While students tell us they wouldn't like to have all of their courses set in Riverbend, they are quite happy to have some more set there. Colleagues are currently considering how they can utilise the site in at least one other course in criminology, and I will be using the site again for a third year course. On these criteria, then, the site can be considered to provide a PBL experience. The PBL cycle for the first six weeks of semester, in which each PBL group had to produce a tender for applied research, is described in the table below:

Week 1	Week 2	Week 3	Week 4	Week 5	Week 6
Orientation to the course and the site Formation of groups of 5/6 students	analysis of the problem prompt in small groups What else needs to be known?	Lecture Small group work sharing findings, starting to plan tender, allocating tasks	Guest speaker Group work reporting on individual work and incorporating new criteria Class debate	Small group work co-ordinating individual's work on tender and theoretical overviews	Submit tenders New prompt supplies extra information raises ethical, political questions

Table 2: The first PBL cycle

Tutors are assigned 15 or so students each, which means they are responsible for supervising the work of three PBL small groups at a time. In the class session in the second week students are presented with the first problem prompt. In small groups, they analyse the problem and decide what else they need to know in order to understand it better. In the normal PBL way they then each investigate whatever aspect of the problem they have decided on and report their findings in the next week. This reporting happens in the context of the larger tutorial group so although each group of five or six has to produce a coherent tender, they have the benefit of other groups' reflections and input. This process continues over several weeks. The WebCT site provides the fictional framework for the prompts, access to further information, both fictional and real, and communication tools such as email and chat rooms which students can use to co-ordinate their efforts in out-of-class time. Their first assessment task is to produce a tender for applied research to solve the prompt problem, and this helps provide further structure for their learning. In each succeeding week they are given extra information, both on the site and in class lectures and debates, which encourages them to modify their understanding of the problem and approaches to it. Subsequent problem prompts are built on the original one, but raise new issues such as ethics. Other assessment tasks are built around oral presentation skills, reflective journals and critical incident analysis. Over the course of the semester, students use their reflections to modify the site by creating personal web pages advertising their skills and by posting summaries of the developing problem, its solution and what they, as researchers, have learned from undertaking it.

The relative economy of using an existing resource such as WebCT to provide a tool such as this means that we can look forward to continuous development of the site over the coming years, to meet changing course structures and student needs. Riverbend is one regional town with a rosy future.

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COLLABORATION – A THREAT TO ACADEMIC AUTONOMY?

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Abstract

Universities have historically encouraged individual academics with research expertise in a discrete area of study to undertake research and teaching in their discipline. In this process academics have had full autonomy, from the discovery of knowledge, the method used to integrate and interpret it, and the means used to convey it to students and to assess student learning.

In recent times pressures for change have affected universities. First, business requires graduates with broad knowledge and skill capabilities as well as discipline-based content knowledge. Second, universities are required to demonstrate quality control and improvement. Third, private expenditure has replaced a previous almost complete reliance on publicly provided university places. Finally, technological advance has made possible more flexible and innovative learning opportunities.

It is argued in this paper that these changes require a new culture of collaboration to supplement academic autonomy. Academics are required to collaborate across disciplines. Cross-functional collaboration is required between academic and non-academics. In so doing the paper calls for university structures and practices that support collaboration.

Keywords

collaboration, universities, academic autonomy

Introduction – The External Environment

It is argued that the productivity of a modern corporation lies more in its intellectual and systems capabilities than its hard assets. Quinn, Anderson and Finkelstein (1996) state that the intellect of an organisation lies within the firm's human brain and includes "cognitive knowledge (know what), advanced skills (know how), systems understanding and trained intuition (know why), and self-motivated creativity (care why)" (p. 7).

Developing intellect, they go on to argue, requires a move away from traditional organisational cognitive skills training to an emphasis on developing the information literacy required by a knowledge economy. Davenport and Prusak (1998) state that Information Technology (IT) increases an organisations' ability to capture data, however it is people that make the data relevant by using their insight to reflect on, synthesise, and turn data into information, then place it in context to create knowledge. In the process of which, Checkland and Holwell (1998) argue, IT changes organisations:

> It stirs things up, introduces uncertainties, gets people perceiving their world in a new way…the introduction of IT will always have implications beyond the merely technical (Checkland & Holwell, 1998; p. 7).

Indeed IT is a mix of many disciplines. Kempner (1987) argues that IT is a convergence of computing and communication. Zuboff (1988) claims it is a merging of microelectronics, computer science, telecommunications, software engineering and systems analysis, computer systems and management, with support from psychology, sociology, statistics, political science, economics, philosophy and mathematics. Boland and Hirscheim (1985) claim it is a convergence of the exact sciences (control theory, systems theory and statistics), technology (computer science and electrical engineering), and the social and behavioural sciences (management theory, sociology, psycholinguistics, economics etc.). Accordingly, the introduction of IT requires significant social and cultural changes within organisations that have been structured to separate functions and responsibilities:

> The setting up of an information system is itself a social act, requiring some kind of concerted action by many different people; and the operation of the information system entails such human phenomena as attributing meaning to manipulated data and making judgements (Checkland & Holwell, 1998; p. 19).

The effect of this confluence of pressures is that organisations require employees with higher-level capabilities than the skill focus of traditional internal training. It also creates a need for adults already in work to upgrade their knowledge and skills (Blustain, Goldstein & Lozier, 1999). This places pressure on public funding of higher education to move to private self-funding. Zammit, Nanlohy and Corrigan (1999) state that:

> the assumption of equal opportunity for all citizens and the reduction of unskilled or low skilled employment opportunities has led to the demand for university education to rise sharply. At the same time governments who fund universities are responding to public demands to reduce expenditure (Zammit et al., 1999; p.2).

Universities have traditionally been the major source of graduates with advanced skill, systems understanding, and intuition. The added requirement for graduates with self-motivated creativity places pressure on universities. Davenport & Prusak state:

> organisations need people with the ability to extract information from those who have it, put it in a structured form, and maintain and refine it over time.....[however, they argue]... Universities don't teach these skills (Davenport & Prusak, 1998; p. 129).

Srikanthan and Dalrymple (2001) refer to the spate of books critical of Higher Education that, they argue, is indicative of growing public scepticism that universities "are not preparing students adequately to face the demanding challenges of the future workplace" (Srikanthan & Dalrymple, 2001; p. 566).

Faced with pressure to expand the capabilities of graduates, rely more upon private self-funding public, and provide for a more diverse educational community, universities have had to reconsider both what educational opportunities they offer, but how they are offered. Students now demand greater flexibility through 'virtual' educational opportunities; a more student-centred approach that recognises capabilities developed though experience, and emphasis upon the global factors affecting business (Nunan, 1999). University response is discussed in the next section.

University Response

The Deputy Vice-Chancellor of the Queensland University of Technology, Professor Coaldrake, has argued for many years the need for universities to provide a different service for students - "students want professional training and acquisition of a credential which will assist their chances of career advancement" (Coaldrake & Stedman, 1999; p. 3). The Business/Higher Education Round Table in 1999 stated that university graduates need to be able to act upon knowledge itself as the outcome of their intellectual endeavour in addition to having mastery of the knowledge within a particular disciplinary domain (Business/Education Round Table News, 1999). Recently the Vice Chancellor of RMIT, Professor Dunkin, stated that knowledge is not just about teaching students about accumulated knowledge; "it can be about engaging them in a process" (Dunkin, 2000; p. 8). Consequently, she argued, universities need to:

> redefine their role within the society and change their approach to teaching - instead of being creators, custodians and disseminators of knowledge they become part of a network of players contributing to problems often identified by external organisations or communities (Dunkin, 2000; p. 8).

Recognition of the need for change has led universities to design opportunities for life-long education and to redesign courses with a cross-discipline graduate capability focus. Reid (2000) cites University of South Australia Graduate Qualities statement that aims to graduate students who:

- can operate effectively with and upon a body of knowledge of sufficient depth to begin professional practice
- are prepared for life-long learning in pursuit of personal development and excellence in professional practice
- are effective problem solvers, capable of applying logical, critical, and creative thinking to a range of problems
- can work both autonomously and collaboratively as a professional
- are committed to ethical action and social responsibility as a professional and citizen
- communicate effectively in professional practice and as a member of the community
- demonstrate international perspectives as a professional and as a citizen (Reid, 2000; p. 6).

The strategies being developed by universities require academics, previously employed to teach students detailed discipline content, to design educational experiences that are student-centred, interdisciplinary, and focussed on developing graduates with knowledge and skill capabilities. Duderstadt (1998) claims that:

> although the primary mission of the university — the creation, preservation, integration, transmission, and application of knowledge — is not changing, the particular realization of each of these roles is changing dramatically. So, too, is the nature of the higher education enterprise as it evolves into a global knowledge industry (Duderstadt, 1998; p. 1)

Academics are asked to recognise the new 'knowledge culture', or how the hardware and software is used by staff and students, the new net language, and the new processes through which knowledge is created, shared and exchanged (Reid, 2000; p. 5). As Privateer (1999) states, universities need to develop a knowledge management strategy underpinned by technology:

> "...a set of common, multidisciplinary learning outcomes for students at a given institution [which] can spearhead a strategically guided approach to technology-mediated instruction" (Privateer, 1999; p. 65).

This new knowledge management strategy must include how best to use the net to improve flexible delivery, quality, and access. As early as 1994 Laurillard discussed how computers could be used to model real world activities and create interactive opportunities for students, and to support a two-way dialogue between teacher and students through teleconferencing. In this way she described computers as being able to "provide students with a simulated environment with which to interact [and to] simulate the real world and to link students to various audio and visual data bases" (Laurillard, 1994; p. 20). In 1999 Hannah claimed that use of the net had expanded to around 36.7 million current hosts, 223 million possible hosts, and 4.3 billion future hosts (Hannah, 1999; p. 2-3). Gerrard (2001) explains how technology 'the third generation' of distance education, enables communication between students that eradicates the disadvantage of 'social distance', which Nipper (1987) had identified as a major disadvantage, by enabling students to share ideas, knowledge, and experience. She explains how at the Open University in the United Kingdom "academics work together in teams to design and develop course material" (cited in Gerrard, 2001; p. 579).

It is this question of how to encourage academics to give up their autonomy and move to a more collaborative model without losing the advantages of a 'collegial' to a 'managerial' approach (Marginson & Considine, 2000), that is the subject of this paper. Indeed a recent RMIT submission to the 'Senate Inquiry into the capacity of public universities to meet Australia's higher education needs' recognised that multiple pressures on university staff produce concern that academics are "losing authority to students on the one hand and to managers on another" (RMIT, 2001; p. 5). The next section explores a collaborative cross-discipline and cross-functional model that aims to both create collaboration and protect academic autonomy.

A Capability-Drive Collaborative Model for Flexible Educational Design

Collaboration for educational design can occur in a number of forms. Lines (1997) discussed two forms of collaboration. First, there is collaboration as 'respectful and informed co-operation between disciplines'. This form of collaboration recognises the difficulty for any professional to be adequately expert in all relevant domains. Collaboration starts with identification of the desired product and assembles a team based on "an assessment of the particular knowledge and skills each member possesses, for the purpose of creating and realising a design. It has no necessary existence outside this purpose" (Lines, 1997; p. 66). Second, there is collaboration as 'a relationship'. This form of collaboration exists as a relationship in which broad ranging conversation occurs between the participants that may lead to work, however there is no predetermined outcome established for the production of work:

> work is something that is generated between two or more people, that could not exist outside the framework of the conversation as is a result of the relationship (Lines, 1997; p. 66).

Either of these forms of collaboration could be appropriate for the purpose specified. However, given that there are pre-determined 'products' for universities, it is more likely that cross-discipline co-operation through collaborative teams is more relevant, at least in the short term. This form of collaboration is discussed in the literature dealing with new relationships between learner and teacher in education (Collis, 1993; Ceratto & Belisle, 1995), but there are fewer writings on collaboration between the designers in the development of such education. It is this latter that concerns this paper.

Laurillard argued that teachers may not have the skills to adapt to a new role as a "facilitator of knowledge preparing, supervising and de-briefing the multimedia assisted learning and providing students with interactive access to large text and audio-based learning" (Laurillard, 1994; p. 21). Indeed from his experience in developing educational delivery through the internet Hannah (1997) claimed that a standard requirement for online educational delivery is new forms of expertise in "electronic inquiry and discourse" (p. 1). Similarly Smith (1997) argued that the teacher has to have the skills to use the multimedia "it falls upon the teacher to constantly recreate the instructional process and offer a variety of choices" (p. 36). Rice and Ryan (1999) argue that on-line delivery cannot be limited to simply the transfer of traditional teaching material to a computer-based learning format, rather it requires new design formats. Finally, in recognising that learners may also not have the skills to use the online educational process effectively, it has been recognised that teachers will need skills to guide the learner in the use of this new teaching medium:

> the learner ...cannot be expected to set appropriate goals, or plot a reasonable path, they will under-specify the problem, be distracted by irrelevancies, be unsure how to evaluate the information they find, over generalise from instances, remain unaware of incompleteness, fail to recognise inconsistencies....there is every opportunity to fail to meet the objective (Laurillard, 1994; p. 24).

Collings separated the knowledge and skills required for teaching or 'real work' from that required for 'articulation' or "the work involved in negotiating the development and use of information technology infrastructure and designing and organising new ways of teaching" (Collings, 1999; p. 5). To address the range of knowledge and skills required Kandlbinger argued for a multi-disciplined teams consisting of "some combination of graphic designers, computer programmers, video makers, animators and content experts" (Kandlbinger, 1999; p. 2). In discussing the practice of distance education at the Open University in the United Kingdom, Gerrard (2001) outlines the team process used to design and design and develop course material:

> All decisions on the structure of the course and module content are collegiate. These academics are assisted by media producers, educational technologists, designers, editors and administrators, but the actual academic development is entirely in the hands of academics (Gerrard, 2001, p. 579).

Accordingly, collaboration between those designing, preparing and delivering online educational offerings is required to ensure that all forms of expertise are included.

The Collaborative Model in Action

An example of collaborative design, preparation and delivery of an online course occurred in 2001 in the Faculty of Business at RMIT University. The collaboration involved is illustrated in Figure 1. The process had a number of collaborative steps, although these could also be simultaneous. First, (A) the academic (discipline 1) responsible for the delivery of a course in negotiation, mediation, and advocacy skills decided that a fictional case study company she had developed as the basis for a mock negotiation could be enhanced as a 'real-life' experience for students by placing information about the company for students to access online through the RMIT Distributed Learning System (DLS).

In collaboration with the Manager of the Faculty Education Media Unit (EMU), a graphic designer and a HTML programmer, a company website, atypical of existing company websites, was designed (B). From an instructional design point of view, this provided the advantage of presenting information in a way that demanded a pro-active student-centred approach to accessing the information. This was translated into a site map by a web-authoring expert into Hypertext Markup Language (HTML). The Manager of EMU also designed a graphic interface for the company website.

Once the website was designed and placed in the DLS, collaboration between the academic and the IT projects officer, the Faculty copyright expert, and the Faculty resource librarian, occurred to hyperlink students to resource material required in preparation for the negotiation (C).

The next stage of the collaboration occurred on a lengthier and more continuous bases between the academic and the IT Projects Officer with the aim of using the DLS system to enable students to meet in virtual groups (D). The academic also required the system to be set up so that she could provide regular updates of information, such as newsletters from the company, notes of meetings of managers and union data sheets, each of which would add to the 'real world' nature of the exercise. The lecturer provided all of the documentation in Microsoft Word format and the IT projects officer converted all documents into Acrobat PDF format and uploaded it to the appropriate area for student access.

Further collaboration is currently developing with academics from other disciplines (E) to discuss cross-discipline interchange between students (specifically accountancy and human resource management students) through this mock case study.

This model worked effectively to deliver the experiential opportunity desired by the academic. Feedback from the students was positive, and there are currently discussions within the collaborative team as to how to improve the experience in the future.

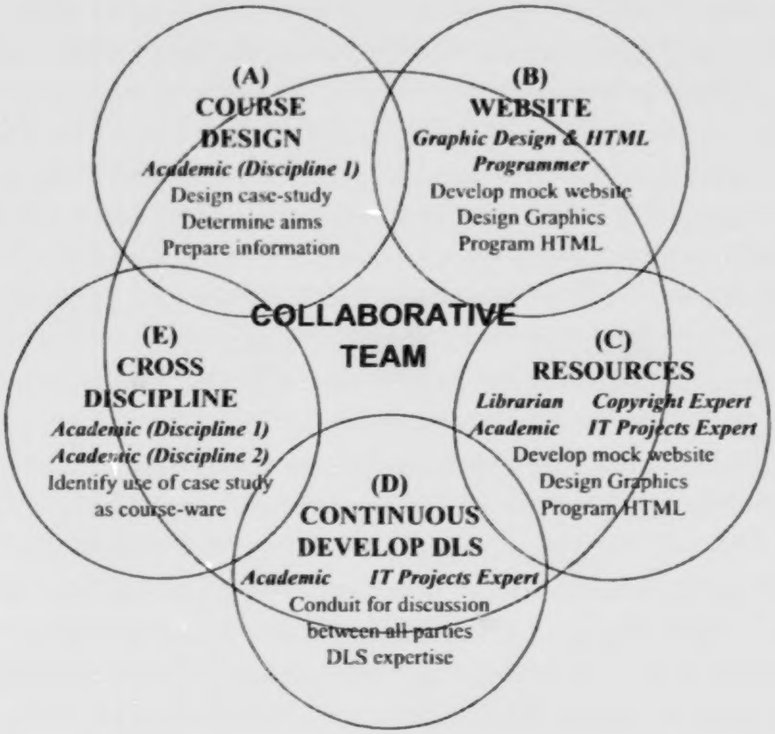
(A)
COURSE DESIGN
Academic (Discipline 1)
Design case-study
Determine aims
Prepare information
(B)
WEBSITE
Graphic Design & HTML Programmer
Develop mock website
Design Graphics
Program HTML
COLLABORATIVE TEAM
(E)
CROSS DISCIPLINE
Academic (Discipline 1)
Academic (Discipline 2)
Identify use of case study as course-ware
(C)
RESOURCES
Librarian
Copyright Expert
Academic
IT Projects Expert
Develop mock website
Design Graphics
Program HTML
(D)
CONTINUOUS DEVELOP DLS
Academic
IT Projects Expert
Conduit for discussion between all parties
DLS expertise

Figure 1: Cross-functional and cross-discipline collaborative model for online design and preparation

This model addresses some of the concerns about loss of autonomy that tends to discourage academics from adopting a cross-discipline and cross-functional collaborative approach. First, the academic retains control over the determination of the aims and objectives of the educational delivery. Second, the collaborative team enables continuous discussion and thus decreases the fear of the academic that the educational process may become technologically rather than people driven (similar to the socio-technical debate that has occurred in industry for many years) (Emery, 1978). Third, the collaborative team enables continuous discussion within the team about what other professional knowledge is required and to what extent that knowledge (e.g. legalities) may limit the educational design. Fourth, the collaborative team process enables academics to explore cross-discipline opportunities to extend student capabilities.

However, the collaborative team process does not address academic concerns of what recognition there will be for their discipline-based research and teaching knowledge and skills if the educational process becomes totally capability based. To address this question it is necessary to ensure that university practices and procedures support a collaborative model. Most important is the practice of rewards and recognition. Universities must reconsider their reward and recognition practices, particularly their recruitment and promotion system, that recognise individual discipline-based research and teaching innovations, and replace it with a process that recognises the knowledge and skills required for collaboration. Promotion based on individual discipline-based research output, awards based on individual 'teaching excellence', must be changed.

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Furthermore universities must recognise the time and cost involved in designing and delivering innovative on-line teaching initiatives. RMIT provides an example of how funds have been provided to encourage the development of on-line courseware for use across disciplines. Jones and Creese, (2001) presented two case studies in which a collaboration approach to developing on-line innovations was funded by the university. However such funding is generally short lived and sporadic and there is little recognition of the time taken for collaborative teams to function effectively in the initial design phase or in on-going maintenance of the online initiative, including the increased student interaction.

Conclusion

In order to provide graduates with the knowledge and skill capabilities to know-what, know-how, and know-why, required by knowledge-creating organisations, universities need to adopt more collaborative academic and administrative models with the aim of designing and developing innovative on-line knowledge-creating opportunities. This paper has presented a collaborative model that addresses some of the concerns about the future role of academics in the educational design process required for online delivery. It is clear that the collaborative model requires that academics retain their responsibility for the educational process. What the collaborative model enables is continuous dialogue, discussion and explanation, with technology supporting the educational aims set by the academic. However, this paper also recognises that such a collaborative model, although necessary as a means to designing and preparing innovative educational outcomes, is not sufficient to encourage adoption of this model. Universities must replace individual reward and recognition practices with recognition and reward for the individual's contribution to the collaborative process. Further, universities must provide sufficient finance to design and develop on-line innovations and make provision for the time required to design, develop and maintain on-line initiatives.

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NAVIGATION SYSTEMS, ARCHITECTS AND ENGINEERS

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Abstract

Interactive multimedia (IMM) navigation systems rely on two key non-graphical components, a schematic or architectural framework and an associated programming solution. Two primary framework types are recognized – branching (structured) and referential (unstructured) – although most navigation systems include elements of both. Programmed solutions to navigational frameworks typically display varying degrees of independence from the frameworks they support, and the role of authoring tools in promoting such independence is discussed. The concept of an authentic navigation system, in which the navigational framework and associated programming are fully integrated, is introduced, and two IMM packages that employ such a system are described. Some advantages of authentic navigation systems are discussed.

Keywords

multimedia design, navigation systems, software architecture, authoring tools

About Navigation Systems

Navigation systems are a pivotal part of IMM projects. Interface elements aside, they comprise two key components; an underlying schematic architecture or framework and the programming or software engineering solution that implements it. Typically, the architecture closely follows the conceptual framework around which the project's content is woven. However, as will be demonstrated, the engineering component of the system can exhibit varying degrees of independence. Oliver and Herrington (1995) identified three types of navigational frameworks within multimedia/hypermedia – linear, hierarchical, and referential – representing the beginning, middle and end points of a continuum based on the degree of linking between individual screens (nodes). The linear end of this continuum is typified by slide show style presentations (as produced by PowerPoint) while purely referential hypermedia are common fare on the world-wide-web. However, comparing these three categories of frameworks in terms of their inherent structure, rather than their degree of linking, reveals a clear distinction between linear and hierarchical type frameworks (i.e. branching frameworks) on the one hand, and those based on referential linking (i.e. networks) on the other. The former exhibit various degrees of structure while the latter are essentially unstructured – most IMM navigation systems typically contain elements of both. As demonstrated by Misanchuk and Schwier (1992), branching frameworks can be characterised using a simple notation describing the degree of branching within the framework and the number of nodes between branches. Figure 1 provides a demonstration of this for a variety of frameworks created from the same ten putative nodes. Frameworks based on referential linking cannot be described in such terms. Each framework is unique and is the product of its constituent links. Thus, all of the branching frameworks in Figure 1 (Figure 1a-d) can be fully characterised by a list of their component nodes (e.g. for Figure 1c the list is 1, 2, 2.1, 2.1.1, 2.2, 3, 3.1, 3.2, 3.2.1, 4), while the referentially linked examples (Figure 1e-f) require a complete list of their component links (e.g. for Figure 1e the list is 1-2,1-3, 2-4, 2-5, 5-6, 5-8, 5-9, 6-10, 8-4, 8-7) – information that is implicit in list of nodes for the branched frameworks.

Earlier, I mentioned that programming solutions to navigational frameworks don't always parallel the structure of the framework in question. This typically occurs when referential linking is used to emulate branched frameworks. It is prevalent in HTML-based hypermedia, where all links are by definition referential, but is widespread across a range of IMM development platforms and authoring tools. The use of referential type linking to create non-referential frameworks is not in itself problematic. However, as will be demonstrated, in certain situations, the use of authentic solutions to essentially branched frameworks can provide real advantages to developers.

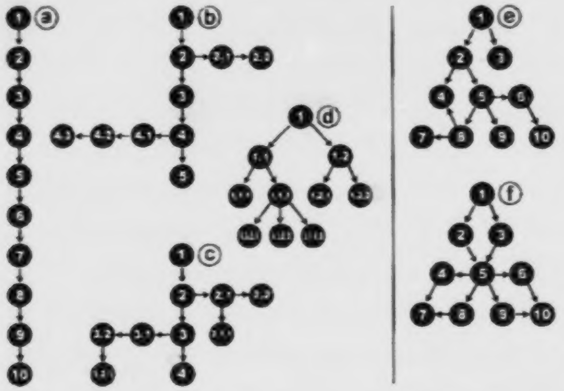

Figure 1: Alternative frameworks based on ten putative nodes: (a) to (d) - branched frameworks, (e) and (f) - referentially linked frameworks

About Authoring Tools

The choice of authoring tool can subtly (or not so subtly) influence both the design and implementation of IMM navigation systems. In the previous section, I described how HTML-based hypermedia makes exclusive use of referential linking. Yet, many WYSISYG web-authoring tools (e.g. Dreamweaver, GoLive) adopt a plainly hierarchical metaphor for displaying/browsing a site's content. This 'mixing of metaphors' can prove invaluable for developers who create web sites that adopt primarily branched navigational frameworks. Once we move away from HTML to the more traditional IMM development tools the situation is very different. With the exception of Authorware, which also employs a 'flowchart' or hierarchical approach for both displaying and building a project's content, the majority of authoring tools adopt a strongly linear development metaphor. So much so, that it can be difficult to implement highly branched navigational frameworks.

In card-based authoring tools (e.g. HyperCard, SuperCard, MetaCard, ToolBook), content is arranged on a 'stack' of virtual cards (nodes) between which the user navigates. Authoring tools based on a timeline metaphor (e.g. Director, Flash) typically divide what are essentially frame-based 'animations' into a series of labeled segments using 'markers' that are navigated in the same way as the individual cards in the card-based tools. PowerPoint represents a special case of card-based tools in that it places content on a sequence of virtual screens, however, unlike most of the card-based and timeline-based tools mentioned, it lacks the scripting/programming capabilities necessary to implement anything other than purely linear navigational frameworks. PowerPoint aside, each of these authoring tools typically provides the developer with two linking methods–linear and referential. In SuperCard for example you can choose to navigate in either direction in a linear sequence using the 'go next' or 'go previous' commands or referentially link to any card in the sequence using the syntax 'go to card' followed by the card's name. These commands are virtually identical across authoring tools, so that in Director, for example, the only difference is that the term 'marker' replaces 'card'. Irrespective of the tool used, however, developers must use referential linking to created branched frameworks and the characteristic solution to most primarily branched frameworks will include both linear (to navigate along branch segments) and referential (to navigate between branch segments) links.

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Authentic Navigation Systems

The term authentic is used here to describe navigation systems in which the programming solutions for the system are based directly on the navigational architecture they implement, and this architecture, in turn, directly parallels the conceptual framework of the project it supports. As outlined in the previous section, both steps require that the dominant navigation paradigm of the development environment and the default methods for linking content are circumvented to some degree.

What advantages do authentic systems offer over those developed on an ad-hoc basis? In many cases none (as far, at least, as the end user is concerned). Navigation systems for small to medium sized multimedia or hypermedia projects are relatively easily implemented without either special attention to the design or implementation of the navigational framework, or undue interference by any constraints the authoring tool may place on the developer. However, where scalability and modularity are important considerations, authentic systems can provide distinct advantages to both developers and clients. The following two examples describe the design and implementation of two authentic navigation systems within multimedia projects developed by the Biomedical Multimedia Unit at the University of Melbourne. Both projects were created using Macromedia's Director authoring software.

Example 1 – DNAexplorer is a computer facilitated learning (CFL) package designed to explore key concepts in the field of bioinformatics (Kennedy, Judd, Keppell, Ginns, Crabb & Strugnell 2001). Its gross architecture consists of four tutorials accessed from a central menu screen. Within each of the four tutorials, the primary content is navigated by 'turning' the corners of a sequence of 'pages', presented within a 'manila folder'. On key pages, supplementary pages of content (termed learning loops) are accessed via colour-coded tabs on the side of the page. Navigation within learning loops is again via the page corners and loops are exited either via the appropriate tab or by progressing to the end (or the beginning) of the loop. In either case, when the loop is exited the user is returned to the screen from which the loop was originally accessed. Learning loops are also occasionally embedded within learning loops and are accessed and navigated in the same way.

The navigational framework described above is essentially a branched linear structure in which the central 'axis' can support up to two degrees of branching (i.e. a learning loop within a learning loop), and is homologous to the 'feedback loop' branching structure described by Misanchuk and Schwier (1992). It was implemented by adopting a naming convention for screens similar to that suggested in Figure 1 (see Figure 1c). A series of generic programming routines were then written to track the name of the current screen, provide access to and from the learning loops, and enable navigation to the next or previous screens in the current sequence. These routines call on the authoring tool's referential linking function to navigate between screens, but the screen names passed to this function are dynamically generated based on the name of the current screen and which navigation-related interface component (i.e. page corner or colour tab) is accessed.

Aside from improved reliability, the main advantage this navigation system over an equivalent ad-hoc system, was the additional flexibility and ease of use it provided during development. Throughout the development phase of the project, new content was added and existing content rearranged on a regular basis and generally the only changes necessary to the navigation system were the renaming of affected markers or screens. Because the system is driven by generic programming routines it was generally sufficient to attach the appropriate navigation-related interface components and, provided new or relocated screens were correctly named, navigation to and from them would function correctly.

Example 2 – Communicating With the Tired Patient is a CFL package designed to develop medical students' clinical communication skills (Liaw, Kennedy, Keppell, Marty & McNair, 2000). In this package, the user conducts a virtual interview between a doctor and patient, from the perspective of the doctor, drawing from a database of prerecorded video and audio clips. Briefly, the interview proceeds as follows. The doctor greets the patient asks them about their problem and the patient responds. The doctor (user) is then presented with between two and four questions they can pose, which vary in subject matter and/or style of delivery. A selection is made and the patient responds.

This cycle of doctor question, patient response continues until the interview is completed. Following each patient response, the user is presented with a series of comments relating to the patient's response. The answers to these questions and the records of the various doctor questions and patient responses selected and viewed throughout the interview are also combined to create an up-to-date transcript of the interview, which can be viewed at any time.

The navigational framework that best fits the conceptual framework described above is a regular hierarchy in which each node is defined by a doctor-question patient-response couplet and gives rise to between two and four similar nodes at the next level. However, because some nodes and their subordinate structures are repeated within the hierarchy, a second referential framework is used to re-map duplicated nodes to existing nodes. Thus, no more than two copies of any given node need exist within the hierarchy. Unlike *DNAexplorer*, which uses an embedded navigation framework, The *Communicating with the Tired Patient* package employs a virtual framework that is dynamically created from a series of external files. These files include a settings file containing a description of the interview hierarchy, its component nodes and associated video, audio and text-based resources, in addition to the video, audio and text-based resources. These resources are loaded on request as the user navigates the interview's virtual framework. As for *DNAexplorer*, the programming used to implement the navigational system consists of a number of generic routines based on a system of referential linking. However, because in this case the framework they implement is virtual rather than physical, the links they dynamically generate are paths to external files rather than names of existing screens within the package.

The navigation system outlined above replaces an ad-hoc system developed for the initial version of the package and offers substantial advantages and improvements over it. In the previous version, the navigation framework was created within the authoring environment and implemented using Director's in-built referential linking function. While not especially difficult to achieve, for some of the reasons discussed above in the 'About Authoring Tools' section, Director's timeline (i.e. linear) development metaphor is relatively ill suited to the creation and management of highly branched navigational frameworks. As a consequence, making alterations to the resultant network of nodes was especially problematic. Moreover, the planned addition of new interviews would, due to their unique character, have required the creation of entirely new navigational frameworks and solutions. By implementing an authentic navigation system we were able to improve scalability and simplify maintenance within a truly modular environment. Moreover, because content development was now independent of software development, development costs and times for implementing additional interview or for evaluating alternative interview structures within existing interview were substantially reduced.

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DEVELOPING INTERNET-BASED STUDY MATERIALS AS NOVICE WEB-DESIGNERS: EXPERIENCES OF TWELVE SRI LANKAN TEACHER EDUCATORS

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Abstract

The communication revolution has stimulated teacher education institutions in many countries in the world to integrate modern technology such as the Internet into their programmes. However, just transferring traditional text-based materials to the web is often counterproductive. This paper focuses on the experiences of twelve Sri Lankan teacher educators as they developed Internet-based study materials, while undergoing specialised postgraduate training at the University of Wollongong, Australia. As experienced teacher educators, yet novices to the Internet, each of them developed a web study guide, targeting Sri Lankan teacher trainees. The study analysed the ways in which the educators transformed information, the design patterns adopted, and the issues they faced. Initially the effects of limited knowledge and skills upon the development of instructional materials that made use of this new technology resulted in the development of limited educational strategies. However, as the experience levels rose, the design of learning experiences became more inventive but more time was needed to influence the way the teachers thought about their learning and the learning of their students.

Keywords

instructional design, web-based learning, novices

Introduction

Teachers are considered crucial in the successful utilisation of technology in education, and the modern teacher has to cater for students who often are active users of the Internet. These students have grown up with the technologies of the Internet, and readily adapt to them, whereas teachers, in contrast, face difficulties in this transition (Bigum, 1998). The successful utilisation of technology in education will depend on how the teachers are provided with the necessary training in technology-based teaching and learning competencies (Kimmel & Deek, 1996; Cornu, 1997). Despite the tremendous advantages of the new technologies in teaching and learning, much of the literature reveals that in reality progress is not as great as expected (Underwood, 1997; Bork, 1995). Not only are teachers observed to be reluctant in using new technologies such as the Internet in the classroom (Bigum, 1998), but University educators were also found to make little use of them (Collis, 1998a; Albright, 1996) and Collis (1998b) claims that 'there is a gap between vision and execution'. Many authors agree that changing the conventional instructional approaches used by teachers is not an easy task, and a 'resistance to change' occurs within the teaching profession (Underwood, 1997; Kennewell, 1997; Robinson, 1997). Although some studies into technological integration in schools and universities reveal that these approaches make a significant impact on educators (Woodrow, Mayer-Smith & Pedretti, 1997; Williams, 1997), it is also apparent that teachers often just use technology to substitute their existing instructional approaches (Kennewell, 1997; Barrowy & Laserna, 1997). Underwood (1997) believes the reason for this is that teachers' practices become more stable over time and maintaining the status quo becomes the norm. He suggested that, 'if change is to be brought about through experience, then that experience must not only be provocative, but it must be meaningful in both a personal and practical way to the teachers' (Underwood, 1997; p. 158).

Teaching and Learning with the World Wide Web

The world wide web (WWW) is increasingly being used as a medium for delivering instruction in the teaching and learning process. With its vast pool of resources and the hyperlinked environment that allows instant access to them, the WWW becomes a valuable tool for facilitating knowledge exploration by learners. Through making discoveries in this information-rich environment, learners can construct meaningful knowledge (Jonassen, 1995, 1996; Jonassen, Peck & Wilson, 1999). Despite the advantages, several concerns about web-based learning have also been raised. These concerns are either pedagogical issues related to teaching and learning, such as 'information overload' (Ryder & Hughes, 1997), navigation issues such as 'getting lost in hyperspace' (Khan, 1997), or technological issues related to hardware and software (Hill, 1997). Cross-cultural differences due to language, teaching and learning styles, and interaction and communication, may also affect the learners in a web-based learning environment (Collis & Remmers, 1997).

Designing Web-based Learning Materials

The features of WWW such as hypertext, graphics, sound and video, and the easy-to-use, point and click graphical interface provide an extensive environment for instructional designers to develop diverse types of learning materials. Many authors assert that careful consideration and analysis is very important when designing a web-based learning environment (Brooks, 1997; Khan, 1997; Ritchie & Hoffman, 1997). For example, Khan (1997) contends that the web has the potential to support well-designed instructional materials. Thus, the design and delivery of instruction via the web requires 'thoughtful analysis and investigation of how to use the web's potential…' (Ritchie & Hoffman, 1997; p. 138).

Brooks (1997) identifies the processes involved in preparing web-materials such as, 'webifying' written materials, adding hypertext links, adding multimedia and online tutoring. He asserts that these processes should be preceded by a planning stage, that includes developing goals and objectives according to the learner needs, deciding on content and developing appropriate activities and finally organising and arranging information. Instructional designers also face the challenge of creating motivational, interesting and productive web learning environments (Duchastel, 1997; Ritchie & Hoffman, 1997) and Starr (1997) identifies, hypertext, delivery of multimedia and high interactivity as three key features of a web environment. He suggests that it is important for the designer to develop an interface that incorporates 'human-computer interface design principles and not just transfer paper or previous non-graphical interfaces to the screen…' (p. 10). Several other authors recommend other features to take into consideration when designing web-based materials. These are mainly in the areas of organisation of information, orientation of the learner within the environment, navigation, interactivity and presentation. For example: keeping simplicity and consistency in the design and navigation, structure text to establish coherence, provision of real interactivity, and visual presentation without distractions are some common aspects identified (Oliver, Herrington & Omari, 1996; Shotsberger, 1996; Starr, 1997; Brooks, 1997; Hedberg, Brown & Arrighi, 1997).

The process of designing and producing instructional materials for the Web can force designers to engage in deep analysis and articulation of the content. In doing so they are also forced to reflect upon their knowledge in new and meaningful ways. Thus, designers function as learners and this is a very powerful learning experience (Jonassen & Reeves, 1996). Further, Hedberg et al. (1997) found that when the focus was on the learning process, less emphasis was placed on the refinement of production skills and more emphasis was placed on design. Gros, Elen, Kerres, Merrienboer and

Spector (1997) support the claims of Hedberg et al. (1997) and assert that previous experiences influence people when they are designing instruction and warn that "…novices at ID who rely on their classroom experiences, typically choose a rather static information delivery approach rather than a learning-support one."(Gros et al., 1997; p. 50).

Background to the Study

Sri Lanka is currently at the stage of integrating Internet-based teaching and learning into teacher education programmes. Under the World Bank sponsored Teacher Education and Teacher Deployment (TETD) Project, a number of teacher educators representing different teacher education institutions in Sri Lanka were awarded fellowships for staff development in overseas Universities, including The University of Wollongong, Australia. The TETD Project also proposed to establish a computer network among the National teacher education institutions (SLTETD Project, 1996). In the near future teacher education programmes in Sri Lanka can be expected to have Information Technology (IT) components integrated into them.

Purpose and Significance of the Study

The purpose of this study was to examine the design processes adopted by a group of Sri Lankan teacher educators, while they developed Internet-based study materials, as novice web-designers. During this process, each designer went through a unique experience where a transition from designing traditional text-based materials to web-based materials occurred. The insights gained through this study provided an understanding of how the teacher educators transformed traditional text-based materials to web-based materials and the problems they encountered in this process, as novice web-designers. Further, it was an opportunity to study specific design issues, associated within a Sri Lankan context. This would be a significant contribution, since Sri Lanka is currently at the preliminary stages of integrating Internet-based courses into higher education.

This investigation was limited to analysing experiences of a small group of twelve Sri Lankan teacher educators in their process of designing Internet-based study materials as novice web-designers, while studying in Australia. These findings cannot be generalised to all teacher educators. However, the findings do contribute to a body of information on instructional design issues faced by educators, in developing Internet-based study materials.

Method

Participants

The participants were twelve instructors from different teacher education institutions in Sri Lanka, who were familiar with using, designing and developing text-based study materials. At the University of Wollongong, they were enrolled in the subject, Information Technology for Education and Training, as a component of their Master of Education Degree Course, in which they were required to develop a web study guide. They were experienced teacher educators consisting of four females and eight males, in the age range of 30 - 45 years. All had more than ten years of experience in the teaching profession, either as teachers or teacher educators. Seven were B.Sc. graduates and the rest were BA or BEd graduates. All were professionally qualified and six had Masters Degrees. Most of them (8) have been involved in developing text-based study materials in Sri Lanka. Only three of the participants were competent in computer use, and only one person was familiar with Internet use. The others had very little or no experience in computer use and Internet use. None of them had designed or developed web-based study materials before. At the University of Wollongong, three participants (who had prior computer experience) were completing multiple IT subjects, majoring in IT for their Masters Degree, while the others were completing only one IT subject along with subjects from other disciplines.

Task

The common IT subject taken by all the participants was, Information Technology in Education and Training, in which they had to design and develop a web-based study guide on a topic of their own choice, as an assignment. This is a basic IT subject which is mainly designed to prepare students to design, develop and evaluate teaching and learning materials using information technologies. Spread out in a thirteen-week time frame, this subject included both face-to-face and online sessions, with many hands-on experiences. The development of a web-study guide ("Guide") was the final project for this subject. It included three key areas; developing skills in terms of the software, conceptualising in terms of the content, and creativity in terms of the design and structure. This process took place in a constructivist environment, where the learners created their own understanding of the instructional design process, through the experience of it (Jonassen, 1996). The emphasis of the task was on the design and how to structure activities to engage learners. Hence, skill development was de-emphasised. Basic skills about creating web pages using Claris HomePage were introduced at an initial workshop held in week two. A collection of Guides developed by previous students were resources that could be studied and reviewed; the topics covered focussed on the theory and application of information and communication technologies for learning. Another workshop to clarify the problems encountered while developing the Guides was held in week ten. The students were encouraged to display their draft Guides and obtain feedback from peers and staff. In addition the instructors provided discussion on common issues, individual assistance and guidance when required.

Data Collection

Data was gathered from multiple sources during the process. A preliminary questionnaire was used to identify each participant's background information such as educational background, experience and subject specialisation. The course instructors were interviewed about the course background, including the knowledge and skill development activities which supported the task. The participants were observed while they were building their Guides and each was interviewed. These interviews made use of the Guides to stimulate recall. The aim was to understand how they planned and progressed through the process of designing and developing their Guides. Both electronic and hard copies of the developed Guides were analysed throughout the process, using a checklist based on instructional design principles. This enabled the specific design approaches adopted by each participant during the development process to be identified. The preliminary analysis identified some key themes. Final semi-structured interviews were held with the participants, in order to confirm these themes and previous information. Reflective reports of the participants, journal writings of the researcher and other artefacts such as course outlines were also used as sources of data.

Data Analysis

Data analysis continued throughout the study, starting with first data collection. The preliminary observation and interview data were primarily coded and categorised while examining for identifiable patterns. As the study progressed, the codes were reformulated, categorised and sub-categorised. The final-interview transcripts were also initially coded using the same coding procedure, and they were further analysed. The reflective reports and other artefacts were used to triangulate data, which facilitated further analysis of results. The data were finally organised under seven main categories: design patterns, planning methods, concerns, influences, issues, support and reflections. The twelve participants' design processes were written as twelve separate cases, based on the above categories. They were carefully examined for similarities and differences, and the design patterns were identified.

Results and Discussion

Process – Design and Development of Guides

Planning methods

In the planning stage of the task, the participants engaged mainly in defining a target group, selecting a topic, finding information and arranging information. All the participants identified either teacher trainees, teacher educators or students in Sri Lanka as the target audience of their Guides. Selection of a topic was based on the needs of their target group and it was mainly influenced by their professional and personal interest in a subject area. Some of them selected specific topics directly from the Sri Lankan syllabi (e.g. Cement Production, Flowering Plants, Mathematics Progression), while the others opted to develop on some new areas they have learnt in their subjects (e.g. Reflective Practice, Clinical Supervision, Computer Mediated Communication). All participants started arranging information by mapping out the content on paper first. Many of them demonstrated a procedure of progressing from the "known to unknown": writing down on paper, word processing, creating web pages and copying the content into it.

Concerns

It was apparent that all participants attempted to make use of this task to develop materials that would be relevant and meaningful in their current profession and Anura's remark, "This topic is a new concept, which is needed to be introduced to Sri Lankan teachers" is an example. They were also concerned about gaining attention, retaining attention, motivating and facilitating the learners. All were concerned about developing their own knowledge and skills as the task was assessed and they wanted to obtain a good mark.

Influences

Numerous factors have influenced the participants at different stages in this process, mainly on selecting the topic, arranging information and inserting specific features in their Guides. The arrangement and presentation of information was influenced by the participants' previous experiences, as evident by following quotes:

> *I have many experiences as a teacher educator and a curriculum developer. I used those experiences mostly in developing this (Nimal)*
>
> *I was mostly influenced by the experience in writing modules (Anoma)*

On the other hand, the previous Guides were also influential. Anura's declaration, "I designed mainly by reviewing previous Guides" was shared by many others at the beginning, but later on some features were changed according to their own interests. However, Yamuna, Nimal and Karu claimed that they were not influenced by previous Guides. Yamuna declared that she did not even look at the other Guides until she developed hers. Epa tried to do something different because at the beginning the course instructors indicated they did not expect something identical to previous Guides. Many were also influenced by discussions with the course instructors who suggested changes to their Guide features such as reducing the length of information and changing the activity type. Learning theories and instructional models also had an influence in the Guide presentations to some extent. Except for Epa and Karu who directly claimed they followed a constructivist approach, the others responded that they did not follow any specific model.

Issues

At the beginning, some were not certain about the purpose of the task. Epa's remark, "I didn't quite realise what a Guide is", reflects this view. Frustrations at the beginning were explained by Nalini as, "There were instances when I came to work, but couldn't proceed, and there was no one to get help from, and I had to stop and go home". Epa said, "I had to learn by mistakes". However, their desire to accomplish the task motivated them to seek help from the instructors, peers or any others to solve their problems. A few changed their topics, because they could not find relevant images and lacked the skills to create them. Epa had almost completed developing his Guide on Factorisation, but changed later when he realised that this topic was not appropriate to present as a Guide. Many started with having a lot of information in the content at the beginning. However, after discussing with the instructors and learning more about Guide characteristics, many of them reduced the amount of information they originally planned to present. Limited technical skills were found to be a major issue faced by all, and novice computer users were affected the most. A strategy adopted by a majority (8) of teacher educators was to buy their own PCs, install the software and practice at home. Many of them agreed that this self-practice, using mostly trial and error methods, helped them immensely in building up their Guides.

Time limitations, work stress and tension were common constraints faced by all. The initial workshop was held in week 2, and the task was due in week 13. However, most of them started planning and designing at a late stage, since all were occupied with many assignments in three simultaneous subjects. Once started, most of them claimed they spent more time on this assignment, since they were very interested in this new subject area. In some cases participants were frustrated at being unable to implement their ideas in their Guide due to a lack of skill. For example, Anoma wanted to show the development process of cement using an animation, but could not do that.

Support

The two workshops were useful for all. The first workshop was useful to become familiar with the software and to start developing the Guide. The second workshop helped them to overcome the problems they encountered while developing the Guide. All were supported by the instructors and some had personal consultations with them to clarify problems. However, many tended to obtain support from peers. The reluctance of some to ask for help from instructors may be due to a cultural influence. On the other hand, the less technologically skilled people obtained help from more skilled people. Collaborative work played a key role in this process. Not only did it lead to the sharing of ideas, but also led to the sharing of resources. For instance, in some cases the same animated images were used by several persons in the group, and six people have shared external web resources to link in their Guides. This indicated a close peer relationship among small groups.

Reflections

The attitudes of the participants were observed to change during this process on creating a Guide. At the beginning most of them were uncertain and not confident about developing web materials, and comments such as, "I thought I wouldn't be able to do this satisfactorily", or "I was very much worried and afraid, thinking whether I would be able to manage this" were typical. At the end of the process, all twelve participants were very satisfied and confident in developing web-based study materials. Comments such as, "Now I think I can prepare any Guide" and, "I have a confidence that now I can do this" have replaced the early comments. Gaining "hands-on" experiences in using the new technology, and the satisfaction of developing their own web material, made a great impact on many, as all were novice web designers. Further, they were also very much motivated to use this experience in their profession, after going back to Sri Lanka, as reflected by Epa's comment, "Now I can contribute a lot to our distance education modules". They developed only limited skills in developing web materials, using one software application. Yet, the impact of this process was so high that the confidence level was raised to a much higher level, from a very low starting level. They also wanted to practice and share their knowledge and skills after going back to Sri Lanka.

Even the participants, who responded at the beginning that they did not intend to develop web-based study materials after going back to Sri Lanka, had a completely different attitude at the end of the process. The following comments expressed by Lal summarises the ideas shared by most of them, at the end of the process:

> *I never thought that I might have an opportunity to move forward with the new technology, during my working period...But now I have had an experience and I realise that these things can be done by us too.*

When asked whether there would be any changes in their Guides if they had to do this process again, all of the participants claimed that they intended to do so. Although most of them have presented their Guides following the traditional instructivist approach, several of them wanted to change their presentations to include more constructivist features, such as changing the activity types and allowing the learners to explore more by linking many external web sites as resources. Yet, a few did not want to change their instructional approach even in future productions, except for including more images and web links. However all the participants agreed that introducing Guides for teacher education in Sri Lanka is a very useful and an effective method of teaching and learning.

Product – Developed Guides

Arrangement of information

At the beginning, all participants identified some common basic components to be included in their Guides, which were An Overview/Introduction, Objectives, Topics/Sub topics, Activities, Feedback, Help, References/Resources. Many pointed out that there was not much difference between their presentations and text-based study materials and, in some cases, distance education materials, except their material had less content, included more activities, varied the placement of activities and included motivational features available in a web environment. However, during different stages of the process, several changes were made in their presentations. Whilst it was difficult to categorise the Guides as instructivist or constructivist, the final versions of the Guides displayed two distinct approaches in the arrangement and presentation of information. These were called, 'a traditional instructivist approach' and 'a less traditional more-constructivist approach'.

Features	'Traditional' approach	'Less-traditional' approach
Presentation of Information	Lengthy descriptions	Brief descriptions
Learning Strategy used	Reading from screen	Finding out information using the resources
Learning Environment	Sequential order in presentation of topics	No sequential order
Flexible environment		
Use of Activities	To recall or apply facts	To engage users to build up learning
External Web links	One as a resource or none	Many linked to support activities
Approach to learning	An instructional approach	An exploratory approach

Table 1: Some examples of features observed in the two types of web study guides

A majority (10/12) described their Guide as an "Instructional guide" or a "Self-study guide". The learning strategy applied in most of these was to provide some information, give some questions as an activity, provide answers as feedback, and indicate some resources at the end to obtain further information. The information was presented as descriptions to be read from the screen, similar to a book. However many participants asserted that this information was essential and Nalini explained that, "For the learner who is learning in isolation, we should provide all the information in our guide". However, they also tried to include some features that they learnt in the course as suitable in a web environment, such as reduced content, small chunks of information, flexible hyper linking and different activities, to make it 'different from a book' (Epa).

Only two people, Epa and Karu, attempted to deviate from this 'traditional' approach. These Guides provided only brief points on the topic and used activities to engage learners in finding out information and building up understandings. Epa declared that, "This is just providing some brief information to find out other information sources...There is a great deal to explore here", and further explained, "I was mostly influenced by the constructivist approach, but I was unable to accomplish it completely." Both of them started planning their Guides in the familiar instructivist way but Karu changed his approach in the planning stage itself, whereas Epa almost completed developing an instructivist Guide, before started on a new constructivist-based Guide. They were more competent computer users and were also prepared to take a different approach from what they were accustomed to. Also they understood the basic features of a constructivist learning environment (introduced in the course). Further these two Guides presented information in a non-sequential manner, whereas the rest of their group directed the learners in a sequence and their Guides were really 'electronic' books.

Activities

All participants had used activities and feedback in their Guides with different intentions. The most common purposes stated by the people who took an instructivist approach were to, "recall facts" or "apply the learnt facts". In these cases, the activities were considered as self-evaluations to "reinforce learning". Some included activities for students to find out information from other sources yet did not facilitate that by providing links to any resources. The learners were expected to seek facts by reading books, or through feedback that provided direct answers. In the more constructivist environments, the activities were used in a different way. Epa provided activities for the learners to find more information on the topic. Karu's Guide allowed learners to build up their own learning through group activities, and feedback was given only as some guidelines. In all the other instances feedback provided answers to the questions.

Karu had linked many external web resources for that purpose. Only this Guide allowed group interactivity through an online discussion area, supporting collaborative learning. There were only two other instances where the learners were given the opportunity to interact with the instructor via email or a feedback form.

Of the twelve participants, only three who were majoring in IT had many external web sites linked to their Guides as resources for learners. Six had a single common web site linked to their Guides without an indication of its relevance to the topic. This was mainly done as an assignment requirement rather than a need of the Guide.

Added features

Features such as images, animations, different backgrounds and font colours, were included by everyone. Some had different background colours, one for each page, and many font colours, to "motivate the learners". Others used a few different coloured backgrounds to indicate different sections and different font colours to specify concepts. Some used a single background colour to keep it "academic" and used this claim to explain the limited number of images and animations which they stressed were unnecessary. As Nalini explained, "They (the learners) are not children. I didn't need to include pictures and animations to gain their attention." Some also thought that their Guides should be 'academic' because of the intended audience. In contrast, people who did include many images and animations claimed that they used them to increase the motivation of the learners and to gain their attention. Anura who found one animated image by accident, later on inserted quite a large number of animations in his Guide "to practice" them. He stressed that these and many other features in his Guide, such as scanned images and external web links, were mainly included for practising rather than academic purposes.

Conclusion

The results reveal that all participants started planning their Guides as traditional text-based presentations that they were accustomed to. However, during different stages of the process, they attempted to change their approaches in different ways. This occurred as they gained knowledge and skills in using the technology. Even though they had to overcome many pedagogical, technological and cultural issues, all managed to complete the task within the time limit. This study outlined an evolutionary process of designing web-based learning materials by a group of novice web designers. Each individual's design process was a unique experience, influenced by many factors such as previous experiences, skill level, assessment and cultural influences. But, despite the intention of all to develop something different from their conventional approaches, most of the products portrayed the same traditional instructivist approach (except for the addition of web features such as hyperlinks and images). These findings support those reported by other researchers (El-Tigi & Branch, 1998; Maddux, 1998; Gros et al., 1997).

The participants had used an instructivist approach to learning all of their careers but in this task they were encouraged to develop a Guide that was based on a constructivist approach to learning. This was a new approach and contradicted many of their strongly held beliefs about learning. Further, the participants were also novice users and this factor caused a majority of participants to follow procedures and use familiar learning strategies. Two participants, who were more confident with the technology, attempted a constructivist approach. In their case, being immersed in the technology-based teaching-learning environment caused them less cognitive load than their peers. As a result, they did not have to exert as much mental effort to use the software. This may have given them the opportunity to experiment with a constructivist approach in their Guides. The desire to be skilled in this new approach and to experiment the multimedia aspects, rather than being concerned about the learning aspect of their Guides, can be related to the excitement of the first experience in using a web-authoring tool. There were also a few people who despite having this experience did not want to change their approach in teaching and learning. These observations support the views expressed by Bigum (1998), Underwood (1997) and Kennewell (1997) on the difficulties in changing practices of experienced teachers. Further, the willingness of many to change from their traditional approach to a more constructivist approach in the future may indicate that they are starting to think in a new way. However, we acknowledge that it is unlikely that a complete transformation of approach will occur after just one experience of developing a Guide. It will take multiple experiences of producing web materials to gain a thorough understanding of the process.

When integrating web-based teaching and learning into teacher education programmes, it is important to recognise that we are not only introducing new technologies but also new approaches to teaching and learning. Just making the educators familiar with the technology is not enough. A more fundamental issue is the way the teachers think about their learning and the learning of their students.

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THE MONASH PORTAL:
MORE THAN JUST A VIRTUAL GATEWAY

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Abstract

The My.Monash Portal (Portal) provides a virtual gateway to support student-centred flexible learning by coordinating several of the university's key resources to meet the needs of students and staff. The Portal is intended to help deliver innovative learning programs, foster opportunities to undertake research, increase flexibility of access to resources and services, support asynchronous approaches to teaching and learning, and allow online teaching and learning environments to be more responsive to changing student needs. In essence, it is part of a recent movement in higher education towards providing a more complete, holistic online environment for students and staff by converging a number of technologies. The project has been developed with an innovative software design model (extreme programming) that involves rapid prototyping, in which iterative and continuous evaluation by staff and students is used to inform all aspects of the project's design and development. This has resulted in significant collaborative activities across a wide cross-section of the university community. This paper will address each of these aspects in turn, concluding with the results of the evaluation processes and future directions for the development of the Portal.

Keywords

Portal, collaboration, evaluation, software, team development

Introduction

Universities across Australia are setting up virtual gateways for their staff and students, allowing them to enter a new world where academic, administrative and support resources are all available online. This is encapsulated by Maslen (2000; p. 10) who said in describing a virtual gateway, 'one moment [students] may be working in a face-to-face environment, then looking for electronic resources in the library, contacting fellow students via email, completing online unit components or electronically changing their personal details'. Monash University is a large institution with campuses or affiliates in Australia, Malaysia, South Africa, Italy and the United Kingdom. The use of technology-based resources is increasing at Monash because of changes in higher education attributed (but not limited) to, funding, diverse student backgrounds (Australian Vice Chancellors' Committee, 1996), changing student expectations and lifestyles, new developments in technology and opportunities for improved approaches to learning and teaching.

The process of developing appropriate technology based tools to address some of these changes has become an institutional point of focus rather than merely the domain of individual departments or faculties. As the use of computer-based technology has moved from the fringes of higher education to become a core component of course materials, administrative functions and communication, issues of software quality, student learning outcomes and integration of computer-facilitated learning (CFL) modules within the (whole) curriculum context have become paramount (McNaught, Phillips, Rossiter & Winn, 2000). The My.Monash Portal (Portal) project is one strategy intended to address this increasingly diverse set of needs of students and staff in a rapidly changing global context. The Portal was released for widespread use in the university in July 2000 after an 18 month collaborative project involving staff and students at the university. This paper reports on the functionality, developmental model, and results of extensive evaluations involved in the construction of the Portal.

Meeting Institutional, Student and Staff Needs

> *The problem faced by any university ... is how to structure itself so that its central academic activity is facilitated, not undermined, by technological developments* (Laurillard & Margetson, 1997; p. 4).

The Portal developed from a proposal in January 1999 to create a virtual gateway to support the strategic priorities of the University by:

- using new technologies to improve learning and teaching by enhancing student learning methodologies and increasing the pedagogical options, integration and scope of the teaching and learning environment;
- providing students with greater choice in terms of the place, pace, time and style of learning and interaction with teachers and other students;
- developing more flexible programs, award structures, accelerated study options and articulation with other institutions.

The broad directions given to the Portal team were to develop a consistent and reliable institutional interface for students and staff, encompassing both administrative and educational functions. Students should be able to move from administrative to educational needs seamlessly. In short, the university required a systems approach that was holistic, rather than segmented, with the functionality to support and facilitate student learning through the use of computer-based technologies.

The planning for the Portal included a review of other university Intranet and Portal sites in Australia and overseas. Only two universities were identified (at the time) as being involved in Portal development. These were the:

- University of California at Los Angeles (UCLA) whose recently released portal appeared to meet the objectives established for the My.Monash project; and
- University of Sydney, whose portal was focused on administrative functionalities only.

Discussions with both universities indicated that portal development was in its infancy and no useful software products were available. A decision was made at Monash to develop the trial system in-house and to use an iterative/evolutionary development process, at least for the initial development phase. In the first instance, focus groups formed a key role in determining the initial functions of the Portal. As a result, it was initially proposed that the Portal include the following (within a consistent user interface), regardless of the role of the user.

1. A common student environment to enable:
- individual customisation and authorisation
- support for student learning, based on interaction with peers and staff using email, discussion forums, video/audio/text based conferencing
- assignment submission and feedback
- access to educational resources, advisory services and information and library services; and
- access to administrative services, including enrolment, fee payment, record checks and amendment.

2. A common staff environment to enable:
- individual customisation and authorisation
- preparation and publishing of educational materials ranging from authoring HTML pages to 'off the shelf' systems
- interaction with peers and students, including tutorial based discussion groups, workgroup support (email, directory service, discussion forums), and video/audio/text based conferencing
- educational management, including distance education management tools, workgroup management, assignment and assessment facilities and
- access to administrative services, information and library services.

Design and Development

> *In reality, complex systems evolve iteratively, even incrementally. It is for this reason that a large segment of the software engineering community is moving toward evolutionary models of software development* (Pressman, 1997; p. 832).

The Need for a Team Approach

The scale of the Portal project and its key relationship to University infrastructure necessitated a collaborative approach from the start, involving a core multidisciplinary team of educational, information technology and administrative staff (including project management expertise). The core group subsequently drew on the wider University community as part of a broader ongoing design and evaluation team. This was accomplished by establishing a reference group and student quality assurance teams in conjunction with two core sub-groups within the project team (consisting of technical development staff and client liaison staff). One of the core sub-groups' tasks was to establish effective communication mechanisms, and work between the end users, educational experts and the technicians.

The Portal needed to meet crucial institutional and pedagogical requirements. These needs were met through collaborative and team-based approaches. The collaborative processes extended out from the development team to encompass a range of potential user groups in the University. A critical decision affecting the outcomes and success of the Portal environment was the selection of a development model. The main design philosophy employed by the Portal team was that the Portal be intuitive, user-focused and useful. This, by necessity, required the input of individuals with a range of specialist skills, including evaluation (Kennedy, 1999), project management (Phillips, 1997), and educational design (Kennedy & McNaught, 1997). The strong team dynamic fostered good communication within and outside the team to produce high quality outcomes for both students and academics. Using this process, the Portal has now become an integrated one-stop-point for Monash staff and students (Bailey, Bromage & Creer, 2000) providing:

- a personalised Web page;
- a single Internet gateway to the university, with links to enrolled subjects, library information, student administration and support services;

- an environment that may be customised by each student;
- subject pages that are customisable by teachers; and
- links (at the subject level) to online computer mediated discussion groups, subject web sites, subject specific Uniform Resource Locators (URLs), and subject specific library links (including past examination papers).

The model of software engineering chosen by the Portal team reflected the collaborative approach to the developmental process adopted by the team in order to meet its goals and communicate with potential users. In Figure 1, the framework that was established is shown, together with the communication pathways that enabled the Portal team to receive input and feedback from a wide cross-section of the university community.

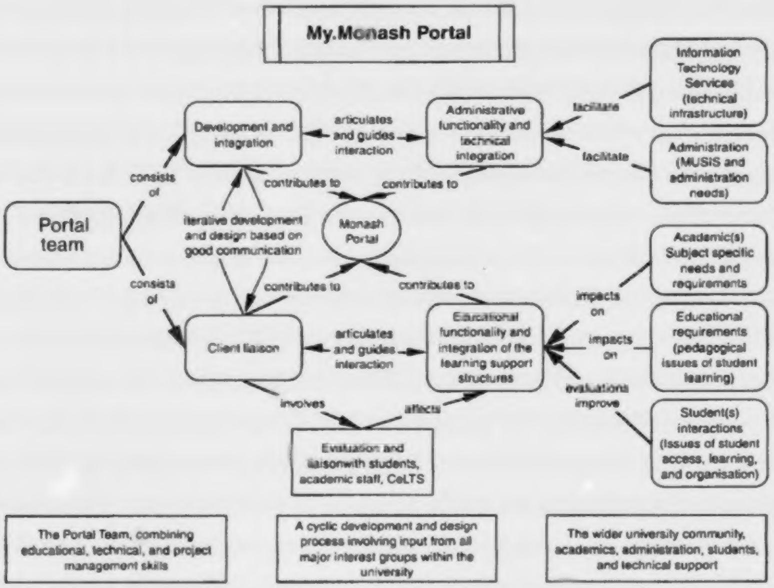
My.Monash Portal
Portal team
consists of
consists of
Development and integration
articulates and guides interaction
Administrative functionality and technical integration
facilitate
facilitate
Information Technology Services (technical infrastructure)
Administration (MUSIS and administration needs)
contributes to
contributes to
iterative development and design based on good communication
Monash Portal
contributes to
contributes to
Academic(s) Subject specific needs and requirements
impacts on
impacts on
evaluations improve
Educational requirements (pedagogical issues of student learning)
Student(s) interactions (Issues of student access, learning, and organisation)
Client liaison
articulates and guides interaction
Educational functionality and integration of the learning support structures
involves
affects
Evaluation and liaisonwith students, academic staff, CeLTS
The Portal Team, combining educational, technical, and project management skills
A cyclic development and design process involving input from all major interest groups within the university
The wider university community, academics, administration, students, and technical support

Figure 1: The cyclical design and development process implemented to ensure input from all stakeholders

Figure 1 provides an overview of the:

- communication mechanisms between the members of the Portal team;
- communication between the Portal team and the Monash community;
- opportunities for evaluation and feedback to support the development process; and
- iterative/cyclic approach to the design and development of the Portal.

A Pedagogical Perspective

Another important principle in the design brief was to enable student control of the learning environment (customisation), reflecting the acceptance of a broadly constructivist view of learning, in which knowledge is individually constructed and socially co-constructed by learners based on their interpretations of experiences in the world (Biggs, 1999; Jonassen & Rohrer-Murphy, 1999; Kennedy & McNaught, 1997). One important aspect of the Portal was the integration of computer-mediated communication (asynchronous discussion groups) to support more flexible student learning environments. The incorporation of online discussion groups has been shown to foster collaborative learning (Agostino, Lefoe & Hedberg, 1997), improve flexibility in teaching and learning (Freeman, 1997), support problem-based learning (Oliver & Omari, 1999), and facilitate role playing activities (Freeman & Capper, 1999; Naidu, Ip & Linser, 2000).

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Evaluation as a Design Process

Phillips, Bain, McNaught, Rice & Tripp (2000) provided a model of formative and summative evaluation. This model is based upon the work of Bain (1999) and Alexander & Hedberg (1994) that addresses interface issues and student learning outcomes in the development of computer-supported learning environments such as the Portal. They argue that early formative evaluation with the target group, or groups, will alleviate many potential design problems. The value of this approach in the context of higher education is supported by Moonen and Schoenmaker (1992) who observed that the interaction of the user with new software is often very difficult to specify precisely, and evaluation of an early prototype 'almost always elicits comments and suggestions for alterations' (p. 118). It is not too strong a statement to say that formative evaluation is fundamental in CFL development if a quality product is to be delivered (Burkhardt, 1992). The Portal has incorporated feedback from all stakeholders in the University to guide and inform the development (see Figure 1).

The development of the Portal utilised a revised version of an evolutionary software engineering model based upon the incremental approach. Such models have frameworks that are iterative, involve the target group early, and are used in situations requiring rapid development (Pressman, 1997). The actual approach used, called Extreme Programming (XP), relied on simplicity, unit testing, programming in pairs, communal ownership of code, and customer input on software to motivate code improvement during the development process (Beck, 1999). This model of software development resulted in short development times, robust software, and good models of communication both within the team and the wider University community.

The core functionalities of the Portal were devised using a scenario-based approach (Carroll, 1995) where teaching academics, the Portal team and students developed descriptions of what functionalities were needed to produce an effective educational and administrative product. Formative evaluation with potential users (students and academic staff) was undertaken very early in the life of the project. From the evaluation feedback, additional functionalities were then added to the Portal environment (see Figure 1). In this project, each release of the Portal was as robust as the programming team could achieve leading to very positive student and staff feedback. There were few implementation problems due to rigorous quality assurance testing conducted by a group of students employed to both 'break' the system and to comment on its usefulness and useability, prior to its initial trial phase and the release. This project is now in a 'post development' phase. However, the development model selected to ensure a robust, highly functional product in the first instance, also ensures that the Portal remains a viable, integrated part of the student learning environment at the university (cf. Alexander, McKenzie & Geissinger, 1998). Bailey, Bromage and Creer (2000) provide a full technical description of the Portal's functionalities.

Evaluation

The evaluation of the Portal was integral to the development process. There were three interlocking stages with each undergoing evaluation. The phases involved an initial design, followed by a trial phase and then a formal release. Initially, these phases focused primarily on learning and teaching functionality. However, since the release in July 2000, administration and support functionalities have been incorporated. The evaluation component of this paper is presented as a unified whole because of the inherently close relationship between the programming efforts and the formative evaluation that guided and supported the process.

A careful selection of students and staff enabled extensive, wide-ranging and realistic evaluation of the system. The formative evaluations of the Portal involved peer review, a walk-through of each iteration, questionnaires, observation of target groups using the software, user-tracking and interviews (individually or in focus groups) with potential users (Stade, Murphy, Webster & James, 1999). The student and staff evaluations informed all aspects of the design, including the user interface, navigation, and how the software functionality supported student learning (Reiser & Kegelmann, 1996). Evaluation involved:

- focus groups of students and staff;

- teaching academics (identified as being already engaged in using technology to support teaching and learning), who completed an open-ended questionnaire;
- an online discussion group intended to provide immediate and direct feedback from staff and students;
- academic and general staff, involved in workshops designed to help them incorporate threaded discussion groups into their teaching and learning (via the Portal); and
- the generation of quantitative usage data from the Portal server and unsolicited feedback from a trial group of over 1200 students enrolled in a variety of modes and subjects including mixed mode, multi-campus, on-campus, distance education and flexible learning subjects in semester 2 July 1999.

Feedback from each of these evaluation processes is examined in turn, briefly. Initially, interviews with 16 students and eight staff to assess Portal functionality were undertaken with the first prototype. This evaluation also informed the design of questions for the future surveying of staff and students during 2000/2001.

The evaluation used the following inputs:

- Students and staff who could not attend the focus groups were contacted by telephone. Their responses were used to guide discussions in subsequent focus groups.
- A small student focus group from a Philosophy subject was invited to discuss Portal functionality and issues.
- Selected staff members were telephone surveyed on a number of Portal issues.

Staff and students were asked the same set of general questions except that questions of staff were focused on the conduct of the subject rather than learning. All but one student found the Portal features useful to their learning. The predominant use was to access the subject discussion groups.

> *...the access to the different discussion [groups] provided access to different points of view. Also it allowed feedback on our own opinions and ideas from the other students. (Student, 1999).*

The Portal also provided improved access to subject resources including, past examinations, assignment cover sheets, web resources and Monash resources. Further, access to the Portal was identified as being through both on-campus computer labs, kiosks and external dial-in from home or other locations, although the predominant use during these initial phases was on-campus.

With regard to Portal functionality, several significant issues were raised, the most prevalent being the functionality of the discussion group interface. This resulted in substantive changes to the interface of the discussion groups prior to the major release.

A number of additions to the Portal functionality were also suggested by several students to further support their learning. These included interactive chat with the tutor, a capability to download lecture notes, and the ability of tutors to issue reminders to students. A timetable function was also suggested to detail all the lectures and activities for the subjects in which the student is enrolled. Staff evaluators also supported these views. The changes recommended by the evaluation were either incorporated for the release in July 2000 or are still being developed in conjunction with other areas of the University. Other comments effecting development received at this time are illustrated below.

> *I believe the portal project is a fantastic idea. With so much dependence on the web for information, it is great students can sieve through or bypass all the info irrelevant to them and have immediate access to the information which they require. The ability to customise your portal adds to the control the student has over THEIR web page. It prevents important information from being overlooked or missed due to overload of information. (BA, student, 1999).*
>
> *I think this is a great service. I have added it to my favourites list. It is a fantastic diving board to access Monash information...(BB, student, 1999).*

> *... please don't ever let this project stop.....I think everyone at Monash [should] have the privilege of experiencing this. (JB, student, 1999).*

> *... I just think that it is an absolutely wonderful idea. Makes everything a whole lot easier. I think that everyone should have one of these.... (EM, student, 1999).*

The simplicity (from a teaching and learning perspective) of integrating the Portal-based discussion groups was evaluated favourably by 57 academics and general staff involved in seven half day workshops to introduce the use discussion groups within a subject Portal subject page. Over 80 percent of participants indicated that the Portal was very simple and straightforward to use, an important criterion for successful use (Kennedy, McNaught & Nicolettou, 1998).

One subject evaluated, HED5001 Designing for Learning, a subject in the Graduate Certificate in Higher Education involved a substantial online component that involved the Portal and an online discussion group. Some of the comments and recommendations received from this subject included:

- Overall, the analysis indicated that the online discussion forum provided a medium for 'lively' interaction between students and staff. This discussion was highly interactive (rather than many postings of independent statements), and relevant to the course content. The discussion forum was evidently not used for social interaction, nor very often for administrative or technical support.
- There was an overall sense that the students were using the discussion forum for two purposes: on a theoretical and conceptual level the discussion was used to debate content covered in the course; and on a practical level to discuss problems and swap strategies for improving the participants' own teaching practice.

> *The portal will be useful to both students and staff in a course context by providing easy access to course material and relevant links. The ease of communicating with staff (through email) and other students (with discussion forums) is a bonus. The features already planned in terms of students setting up their own discussion forums, or for academics to set up smaller groups for discussion will be a potentially useful tool for managing and helping the group process. In terms of technological support this is a great start to thinking about flexibility. (AC, staff evaluator, 1999).*

An open ended questionnaire was distributed to ten staff who taught using a Portal supported subject in Semester 1, 2000. The responses form a series of vignettes that illustrate the impact of the Portal in providing a mechanism for online learning that did not previously exist at the university. The results indicate that as staff and students became more familiar with the Portal, new dimensions of its use for learning were explored, and unforeseen pedagogical benefits emerged, including its use (particularly the online discussion groups) as a central tier for developing flexible learning environments.

> *The portal enabled an important link to develop between a diverse group of students who all worked and studied in different areas of nursing practice. It also provided the medium to better enable a transfer of theory to practice. (AB, lecturer, 2000).*

> *[The Portal enhances the] ability to work in groups at a distance. Ability to read other student's input, and hence develop ideas by considering other students points of view is very useful. (MI, lecturer, 2000).*

> *In particular, given that the two subjects were Asian Studies subjects, it was a great opportunity to students from Malaysia and Australia to share the perspectives of their country on the same issues. (HR, lecturer, 2000).*

> *I observed that it [the Portal] served as an ice breaker because the students 'knew' each other and had communicated with each other before they met on the course (a Block week of teaching). It facilitated [face-to-face] discussion right away without the need for them to*

> *introduce themselves. The ones who had been active seemed to be a bit more into the subject than the ones who had not taken part. (EF, lecturer, 2000).*
>
> *[The Portal provided] a means of fostering communication between students on three geographically separate campuses. (HR, lecturer, 2000)*

Quantitative data was also collected and analysed. For example, there have been more than 4000 staff members and 17,000 students who have accessed the Portal. More than 180 subjects are directly linked to the Portal and many other subjects have resources that are accessed via the Portal. On the release day, over 1800 people accessed the Portal. Typically, 1000 people access the Portal every day (Portal statistics report, August 2000).

A qualitative account of a variety of components and services offered through the Portal is available through archived comments by users of the Portal received via an in-built feedback mechanism. The team uses these, along with other forms of feedback, as a way of continually formatively evaluating the Portal and bringing issues to the attention of the development team. Table 1 shows the breakdown of unsolicited comments (mostly critical of problems encountered, but some requesting improvements) from students (67%) and staff (31%) via a discussion group incorporated into the first release of the Portal. The bold comments in parenthesis indicate changes that resulted from the feedback (and 'N' is the number of comments received).

Category of feedback	**N**	**Example of feedback received (and changes made)**
General Portal	50	(The) drop down list of staff. Students can keep certain staff in personal address book. Great idea, very convenient, and the customisation feature is great. (I have much) better access to resources (now).
Subjects	24	The subject Portal pages need to open as a new window so the Portal is not lost. **(not implemented following useability testing)**
Customisation	17	It would be good if I could use an external email address within the Portal. It would be good to have email via the Portal. **(since implemented for staff, and students can set a forwarding address)**
Discussion	15	Unsure how to visit newsgroups. **(online documentation has been created to support getting-started with the Portal)** Can't find reply emails from lecturer.
Technical	10	I can't use the service provider recommended – can't access Library information **(a problem with certain Internet Service Providers which has since been rectified).**
Look and feel	6	(Need) a more visual approach to home page interface **(the Portal has had a series of interface designs in response to feedback)**
Navigation	6	No way back from the Portal to the Calendar.
Log-in issues	4	(Is there) any way to log out of the Portal? **(since implemented)**
Weather	3	Good to have access to forecasts.

Table 1: Comments from staff and students after the initial release of the Portal

Overall Impact of the Project and Proposed Developments

Between January and May 2001, in excess of 31,000 students and 5,000 staff accessed the Portal. More than 9,000 students are frequent users who access email, student records and administration, and subject-based discussion groups (in order of usage). Following the initial suite of evaluations, changes and additional functionalities identified were implemented and ongoing development has continued in 2001. The current major task of the development team is to integrate WebCT (Campus Edition) into the existing Portal environment to provide more direct support for teaching and learning activities. All evaluations of the Portal to date indicate that this is a worthwhile and useful project for both staff and students of the University in facilitating and supporting teaching and learning using web-based technologies. The Portal will continue to evolve as ongoing evaluation occurs, resulting in new software releases with additional functionalities, reflecting the ongoing collaborative nature this innovative development. The convergence of the Portal and other proprietary products (e.g., WebCT) will enable more diverse administrative and educational functions to be supported.

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WHERE ACADEMIA MEETS MANAGEMENT: A MODEL FOR THE EFFECTIVE DEVELOPMENT OF QUALITY LEARNING MATERIALS USING NEW TECHNOLOGIES

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Abstract

This article explores the perennial tension between the demands of management for quality product which can be used to attract new markets and students and the traditional scholarly approach to learning. Universities are unique environments compared to industry settings. They are unique in that the responsibility for the quality of the teaching material rests with highly autonomous professionals. The feeling is that the application of traditional project management techniques with tight deadlines and the production of a product at the end does not fit scholarly activities requiring reflection and discourse. The costs of setting up new learning technologies and the skill sets required to generate quality materials are driving the need for more effective course development processes. This is forcing institutions to re-assess how course development projects using new technology are undertaken. This paper offers a model which aims to combine the effectiveness of project management techniques with the scholarly approach of action learning, based on research and the experience at RMIT.

Keywords

planning, project management, quality, scholarship, action learning

Introduction

Programs and courses are under continual improvement in all institutions, even if there is no formal documentation of the process. The existing climate of shrinking budgets in which most institutions operate means that all processes operating have to be examined and their benefits captured to ensure that any potential benefits to the institution are delivered.

The RMIT Teaching and Learning Strategy (1998-2000) set the development of more flexible and student centred learning as a key to the future survival of the university. A series of initiatives have been born to implement this strategy. RMIT decided that the development of a new online learning and management system was a key component of implementing the Teaching and Learning Strategy. As a result, about 50 million dollars has been allocated to develop and maintain the Distributed Learning System (DLS) and the Academic Management System (AMS).

The DLS has been in operation since Semester One 1999 and its use has grown rapidly (see Table 1 below). The DLS consists of a suite of web-based course development tools operating behind a secure portal which enables students to access their learning resources and other university services over the local internal network or over the internet.

Version of the DLS	Number of registered courses
Benchmark – semester one 1999	45
Semester two 1999	225
Semester one 2000	683
Semester one 2001	1053

Table 1: Growth of number of courses registered in the RMIT DLS (source, DLS system data)

The AMS is still under development and is due for its first release in October 2001. It aims to integrate all university processes to enable staff and students to access RMIT services via the web, anywhere, anytime. These developments are moving a long way towards increasing access and flexibility for students.

However, the use of the technology to deliver courses to students has raised a number of economic, pedagogical and staff development issues.

> At RMIT, the strategy is to use the new technology as a means of encouraging a re-thinking of teaching and learning practices, not simply transferring established practice to an online environment. In this case, the technology becomes a medium to promote professional growth (Kenny & McNaught, 2000).

The costs of the implementation have led RMIT management to look for return on the investment, however, the skill levels of staff, and the resources available to design and develop quality materials for the online environment have lagged behind the managerial requests. There is an on-going tension about how to address the issues of the need for quality products and the professional growth required to learn how provide meaningful learning experiences using the DLS.

Quality Problems with Targets

The RMIT Teaching and Learning Strategy (1998-2000) advocated that RMIT must adopt more student centred and flexible approaches to learning to survive in a more competitive education market. Targets were set as a part of the RMIT Teaching and Learning Strategy (1998-2000) to achieve 60% of courses 'with some flexible component' by the end of 2000. A key for achieving this flexibility was the adoption of online technologies. The new technologies provide the impetus to re-consider how teaching and learning are organized within RMIT; they are a catalyst for the renewal of programs and courses as well as student administrative systems to make them more responsive to student needs.

The rapid growth in the use of the DLS, illustrated in Table 1, does not give the full story. Many departments concentrated on meeting the 60% targets by having courses created on the DLS. When a formal review of the courses on the DLS was commissioned in semester one 2000 to ascertain the progress towards offering more flexible courseware online and to gauge the return on investment. The quality review (McNaught, et al., 2000) showed some concerning results. About 50% of courses on the DLS were 'empty shells' with little or no course material or activity. Most of the rest were grossly under developed. Among the recommendations from the review was the establishment of clear QA processes, to be applied all to courses using the DLS:

> The ongoing need for toolset training to be linked to educational design training was noted. The need for professional development related to these new emerging QA processes is also clear (Kenny & McNaught, 2000).

The result was for management to call for more evidence of a return on the investment. Faculties were asked to identify strategic courseware that could be developed more rapidly. Unfortunately the underlying planning processes and resourcing was not in put in place to facilitate it, so this process has encountered problems also.

The Issue of Quality

Quality Assurance is an institutional issue and most institutions now have processes in place. Bates (2000) links quality and cost effectiveness with the use of project management processes

> For high quality, cost effective results, a project management approach is recommended, based on funding tied to clearly articulated project objectives, team work, defined budgets and production schedules (Bates, 2000; p. 2).

He describes (pp. 68-75) a project management process which is based around developing an initial project proposal. In developing the proposal, the project is thoroughly defined, the expectations of all parties is clarified and ultimately the proposal is signed-off by the head of department and the dean. A university wide board then decides on the projects to receive funding based on a set of criteria.

Experience indicates, Kenny (2000), that careful institution-wide planning processes are required. Inglis, Ling and Joosten (1999) maintain these should be negotiated between all those involved in the initiative, operate at all levels of the organisation

> This does not imply that the vision of the project and the planning of its implementation need to be a top-down process. On the contrary, there needs to be ownership, vision and enthusiasm at all levels of the organisation. (Inglis, Ling & Joosten, 1999; p. 143)

However, unless the evaluation occurs in the context of the institutional processes at large, then the valuable learning opportunities inherent in these projects will be lost to the institution. Laurillard (1997) contends:

> The university must have a technical and pedagogical innovative environment for R&D projects providing opportunities to trial and experiment and to collect feedback on these via the quality assurance process. ... Many such pilot experiments in universities have been conducted in isolation from the universities management process.

Bain (1999) considered evaluation reports of several projects, and concluded that the context in which an innovation is occurring has to be considered.

> ...the benefits were short-lived and/or did not transfer. This finding offers a salutary caution to all educational innovators and underscores the need to view innovation within the institutional contexts in which it will thrive or die...(Bain, 1999; p. 170).

A Cultural Shift - A New Way of Working

Bates (2000) compares a university to a "Post-Fordist" organisation, particularly as developing quality programs involves teams largely self-governing experts loosely held together by a common goal or purpose.

> Teaching with technology requires a high skill level and this necessitates training not just in technological matters but also in educational practice. Training needs to be embedded in the course development process and the project management model can assist this. (Bates, 2000; p. 3).

The complexity involved in producing quality online courseware necessitates that the process be an iterative one. It will usually require the formation of development teams with a range of skills. These include project management skills, educational design expertise for the web and possibly technical production skills.

This is a new way of working for many academics, who, as content experts, are used to working and developing course material either alone or with other academics. In the online context they will be required to collaborate as a part of a multi-disciplinary team to produce quality courseware. This is particularly the case when a program level re-development is being undertaken.

Much of the initial renewal activity on the DLS during 1998 and 2000 has occurred with little understanding of the nature of the new learning environment or the complexity of the development process. The time and support required for staff to adapt their teaching styles to the use of the DLS and be able to develop educationally sound approaches has been under-estimated and under resourced.

When we consider the complexity of program renewal, this focus on improving quality through the professional growth of staff is very important. Taylor (2000) explains this in terms of nurturing cultural change.

> Quality is an important issue, and as progress is made, it will assume a more salient position in the scheme of things. But success in persuading staff to engage with new technology will depend upon engendering and nurturing cultural change in the faculties, with emphasis on their need to re-think their pedagogical approach and curriculum design to take account of the new technology, not on their capacity to generate product.

Program Renewal

The term 'Program Renewal' has been coined at RMIT to describe the process of re-shaping and re-organising the learning experiences of students to better reflect the requirements of the modern work environment. Teaching staff are being asked to examine the traditional approaches and content to ensure that the Graduate Capabilities (Bowden, Hart, King, Trigwell & Watts, 2000) and life-long learning principles are developed and assessed as central components of students' experiences in all programs. The Graduate Capabilities include many generic skills which studies have shown are required for make learning more relevant to the requirements of the modern workplace.

Kenny and McNaught (2000) point to the complexity of the task

> To promote quality in teaching and learning is a complex task. In the classroom, it has to do with the teaching practices, student capabilities, resources, design of the subject and the types of assessment undertaken. Many staff may need professional development in some of these areas to go along with the training and professional development associated with the use of new learning technologies themselves. .... Teachers may therefore feel uneasy on two accounts; they are learning new skills while operating within an unfamiliar environment.

There is a considerable amount of professional growth and learning required to produce quality courses and programs in any medium, but the technological medium presents new challenges.

A Model for a New Process

It is clear that the development of quality courseware is a complex process. According to Shenhar and Dvir (1996), the more complex projects require higher levels of communication through multiple channels, many professionals and academics on the project and a moderately flexible management style expecting many changes.

Management style becomes progressively more flexible as the complexity of the project increases. In terms of the project which they studied

> all of the projects had a regular system of meetings for problem solving and information sharing…In general the atmosphere in these meetings was one of open communication and continuous discussions. Projects had to employ a much more flexible attitude and they had to make extensive trade-offs. We described this style as moderately flexible (Shenhar & Dvir, 1996).

Critical Success Factors

The development of innovative new courses therefore relies on the capability of staff to use the system in creative ways. Learning to use the technology is therefore a major change and innovation project in itself. Lester (1998) identifies five critical factors for successful projects.

1. Senior Management commitment
2. Organisational structure and processes that support the venture
3. Attractive new product concepts that support the venture
4. Venture teams with appropriate staffing and resources, able to communicate effectively with management and markets
5. Project management able to focus on reducing uncertainties as early as possible.

Other researchers quoted in Shenhar and Dvir (1996) investigated critical success factors for the management of projects, identifying a universal set including: project mission, project planning, project control, top management support, customer involvement, … From the study of educational technology projects, Alexander, McKenzie & Geissinger (1998) identified a similar set of success factors for educational projects in tertiary institutions. Success here being defined as leading to improved learning outcomes.

Balancing Scholarship and Management

For Bates (2000), the main advantages of the project management approach is the efficient allocation and use of scarce resources. Each year staff time is allocated to the approved projects. However, there is a clear tension between the classic project management approach, and the traditional way in which professional staff at a university work. Traditionally, teachers are experts used to quite a degree of autonomy in their work.

> The biggest problem with this approach is that it is often alien to academic environments, where teachers and instructors are used to working as autonomous individuals, especially with regard to their teaching (Bates, 2000, p. 72).

In an attempt to overcome this problem, which is largely a cultural one, Bates (2000) advocates

> … a much looser project management approach that specifies responsibilities and completion dates but does not attempt to quantify every activity on a micro level. The project manager and the academic have a good deal of freedom to move resources around and adjust schedules to meet the reality of academic life.
>
> However at the end of the day, there still has to be a course developed and deadlines met. (Bates, 2000, p. 73)

This compares favourably with the project management model proposed by Shenhar and Dvir (1996) which suggests more open management systems and communication processes and addresses some of the concerns put forward by Phelps, Ledgerwood & Bartlett, (2000) about their experience of working on academic development projects.

Promoting Scholarship

Complex projects such as program and course renewal are well suited to an 'action learning' approach (Zuber-Skerritt, 2000). 'Action learning' is scholarship in action. Integral to the process is reflection on learning, sharing the learning with others and applying the learning to improve the next iteration. Bates (2000, chapter 3) refers to the "Lone Ranger Model" of development of technology based materials. This is the traditional approach of providing seeding grants to fund individuals as early adopters. Among the disadvantages of this model he cites the difficulty in budgeting and planning for such an approach and "dissemination of knowledge gained from the experience is often poor or haphazard."

Laurillard, (1993) proposed the 'conversational model' of learning. In essence, she contends that learning occurs when the student acts for a particular purpose and then receives feedback on that action. Laurillard (1997) claims that a similar model of learning can be applied at the institutional level to create a 'learning organisation'. Kenny and McNaught (2000) support this and see the quality processes of an institution as one means of establishing the 'conversation'.

> Thus the institutional quality processes need to be such that the culture and procedures encourage the flow of information across subject, course, departmental and faculty boundaries. It is the contention of this paper, that where quality cycles do not enable this flow of information, the lessons learned do not easily go beyond the subject concerned. The quality educational experiences may remain isolated instances rather than a common occurrence, expertise is not shared, students do not benefit and the ROI is reduced. (Kenny & McNaught, 2000).

In a learning organisation, therefore, there needs to be a conversation or 'learning' across the institutional boundaries. There must be information flows so that these conversations occur across boundaries. For institutional learning to occur, the course renewal teams must have a conversation, or share information, with other groups in the institution. The project management model employed will need to recognize this and incorporate it into the resourcing, planning, monitoring and communication processes for the project. However there will need to be a 'conversation' with other Renewal Program teams across the university also, a sharing of information and learning.

A culture of scholarship requires an institutional adoption of both the philosophy of reflective practice and the processes to support it. A 'learning organisation' needs to develop an effective means to capture and make known the learning occurring in the range of projects which are underway and to maximize the staff capacity to carry-on further development. The quality assurance (QA) process is an ideal vehicle for this as the development of quality programs and courses is a cyclical process. The QA process involves cycles of reflecting, planning, implementing, evaluating and reflecting.

For an organisation to benefit, staff have to be actively encouraged and supported to carry out action learning as an integral part of their work. This has implications for how projects will be set-up, resourced and evaluated. Quality has to be continually maintained, so it is essential that the capability of staff is developed along with the learning resources, so that continual improvements can be made.

The critical part of the process is the reflection. Biggs (1999) supports the importance of reflection as part of the learning cycle,"...my own assumption is that helping teachers to improve their teaching is best done using a theory that helps teachers reflect on what they are doing." (p. 60). Most project management literature derives from the study of industrial projects, and does not necessarily directly map across to the environment of educational development projects a tertiary institution. Sheasely (1999) studied a technological process to develop a new product, and he draws on an example from the chemical industry. He discusses the distinction between developing new technology and developing new products.

> Developing new technology is fundamentally different from developing new products. In the former case technology is the end result, in the latter it is the raw material. (Sheasley, 1999; p. 49).

What he means is that the 'product development' uses the 'technology' which has been developed. Technology development is essentially research, product development is the application of that research.

Boyer (1990) advocated that academic work has four aspects: discovery (research), integration, application and teaching. In translating the example given by Sheasley (1999) to a tertiary education sector, we see that the 'product development' does not merely involve the adoption and application of a new technology, it also involves the change and professional growth on the part of the staff who have to use the technology as a part of their professional practice. (Phelps et al. 2000). The new product (a renewed course for instance) requires the staff to use technology in new and innovative ways. The implementation of the technology stimulates innovation through its. Sheasley (1999) proposes that such innovations (discovery) are best managed using a process called 'cycle time management'.

> Cycle time management is a process oriented approach to work activities in which time is the primary basis or driver upon which the overall process is designed and optimized. (p. 51).

In the context of the university sector there is a natural 'cycle time' at play, for example, academic year. Each year or semester involves a new iteration of a course, a new batch of students and so presents a natural rhythm for evaluation and revision. The periods allocated for preparation, examinations, correction, etc are all usually pre-determined by the organisation and each has its own particular demands. It makes sense from a management point of view to acknowledge the constraints under which most academic staff work within any project management process. Any project development cycle should fit into the natural rhythms of the organisation.

The Sheasley (1999) management strategy for such discovery is based on 'expectations', which focus on learning and an expectation of capture of this learning.

> 'Each review should consist a reiteration of the previous outlook for learning, a presentation of what was done and what was learned and a new plan for the research in the upcoming phase, with the ultimate goal for performance advances always in view.' (p. 54).

This process above fits in very well with the proposition of the quality assurance process advocated in many institutions today.

A Model Planning Process for Tertiary Institutions

The foregoing discussion suggests a planning process has to address both the demands for effectiveness and scholarship. Such a process would take advantage of the efficiencies of project management techniques, yet promote a course development process more suited to academic reality. The model presented here has been derived by drawing on current research and experience. It aims to enable tertiary institutions to produce quality outcomes in educational projects and maximize the effectiveness of new technology

The planning process advocated involves the incorporation of key project management processes with the realities of life in tertiary institutions. To achieve quality, the organisation has to put in place processes to enable staff to plan, reflect, share and document their learning. This is where the project planning aspects can really begin to add value and commitment to the to the process.

The project management plan would have to ensure that there is sufficient resourcing provided for professional development activities and that this occurs as a part of the faculty departmental planning processes. Such activities as team meetings, materials development and testing require considerable resources and time, as does professional development to address the key pedagogical questions. These issues need to be considered very early on in the process as there is a considerable 'lead time' involved in most institutions, with planning occurring on an annual basis. The professional independence of the content experts needs to be maintained with their responsibility for the content development, but within a context of a commitment to on-going reflection and improvement of the educational outcomes.

Key Characteristics of the Model

The complexities of producing quality educational outcomes has been discussed and the centrality of the capability and professionalism of the staff to achieve this is recognised. The model aims to combine the benefits of project management to ensure the conditions are set-up to enable quality educational outcomes and value scholarship and ownership within the project teams and the individual staff members. For these outcomes to occur, the process needs to be embedded within the institutional processes and must include the following key elements:

- Direct links with the institutional and faculty strategies
- Project leader (manager) is appointed
- A full project proposal is developed, costed and signed –off
- On approval, a Project Team is put in place and they develop a full plan in line with the proposal.
- Time lines and planning account for the cyclical periods or natural rhythms of the institution.
- Staff workplans and reward systems reflect their commitment to the project.
- The Plan resources and promotes scholarship through reflective practice by the adoption of 'action learning' processes.
- The plan embeds the professional development and support
- The communication and reporting processes facilitate sharing of the learning between project teams and across institutional boundaries.
- Has a direct link with the quality assurance processes through peer review, user trialling, student feedback, etc.

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A COLLABORATIVE INTER-DISCIPLINARY APPROACH TO THE EVALUATION OF THE CLINICIANS HEALTH CHANNEL

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Abstract

The Clinicians Health Channel (CHC) is a web-site providing online access to current, accurate and reliable sources of information to help inform and assist clinicians in decision making, research and education. Resources include an electronic health library with citation databases and full text journals, links to other clinical reference materials, such as guidelines and protocols, and provision for discussion forums on clinical topics. An inter-disciplinary, collaborative team from the University of Melbourne is undertaking an evaluation to determine how successfully the introduction of the CHC has met its original aims specifically in relation to the development, implementation and impact on changing behaviour and increasing usage of evidence based health care. A number of key research areas have been identified as important to the evaluation and development of the CHC. These identified research areas fall naturally into the three dimensions - technical, social and behavioural - of our conceptual framework for the evaluation of the CHC. This paper examines the progress on a three-year evaluation of the CHC. It examines the evaluation approach, methodology and insights obtained at the end of Stage 1 of the evaluation.

Keywords
evaluation, web-based resources, focus groups, interviews, questionnaires

Rationale

Clinical decisions about options for a patient's care should be based on both individual clinical expertise and best available external clinical evidence (Sackett, Rosenberg, Gray, Hayes & Richardson, 1996). However, it has been estimated that for the medical profession to keep up to date with advances in drugs, treatment and technology alternatives, they would need to read 19 articles per day, 365 days of the year (Evidence-based working group, 1992). Computerised information resources, comprising both synthesised evidence and original research, made available to clinicians via telecommunication are increasingly being advocated because it is believed that they can provide better access to and use of the evidence to allow the clinician to keep up to date and enhance the quality of care (Lindberg, Siegel, Rapp, Wallingford & Wilson, 1993; Elson & Connelly, 1995).

However, these resources have had limited use in direct patient care settings, meet only a small part of clinicians' information needs, and have not had significant impact on clinical practice. While some may disagree with the need to prove benefit to advocate the use of information resources, most will agree with the need for further research into the content and delivery methods as well as the social and behavioural impacts of such resources on clinicians, their patients, work practices and organisations (Gorman, Ash & Wykoff, 1994; Covell, Uman & Manning, 1985; NHS Centre for Reviews and Dissemination, 1999; Hersch & Hickam, 1998). Our evaluation is thus concerned with the use of evidence-based information in the context of clinical practice, and with the use of web-based media to facilitate evidence based practice. In line with these views the Department of Human Services embarked on a plan to integrate existing information sources in an attempt to change clinical work practices by improving decision-making capability using electronic sources of information. The result of this ongoing work is the Clinicians Health Channel.

Clinicians Health Channel

The introduction of the Clinicians Health Channel (CHC) is a four-year project which aims to provide equity of access to critical clinical knowledge resources for clinicians in the public health care sector throughout Victoria. The CHC (online) is a web-site providing online access to current, accurate and reliable sources of information to help inform and assist clinicians in decision-making, research and education. The CHC aims to facilitate electronic dissemination of these resources so that the information can be accessed whenever and wherever required. It is thus used to support integration of evidence based practice into the health care system. It allows access to an electronic health library with citation databases and full text journals, links to other clinical reference materials, such as guidelines and protocols, and provision for discussion forums on clinical topics.

Rationale for Evaluation Approach

Our approach to the evaluation is notable in three key respects. Firstly, the evaluation is conceptualized as the evaluation of strategic change to work-practices, not simply as the evaluation of a web-site. Secondly, and as a consequence of this broad conceptualisation, the team is multidisciplinary - made up of people with experience and expertise in medicine, multimedia design, educational evaluation, socio-technical relations, workplace ethnography, and qualitative and quantitative research methods. Thirdly, the approach is one that intends to be formative as well as summative, and takes the CHC to be an emergent system rather than stable or fixed.

Evaluation of the Clinicians Health Channel

The evaluation is an integral part of improving the quality and usefulness of the CHC. The University of Melbourne team has adopted a collaborative approach to research and evaluation of the CHC, and the wide range of disciplines represented on the team is a major strength. The evaluation focuses on issues related to professional clinical practice (specifically, an anticipated increase in the practice of evidence-based health care), and on issues related to technological mediation (specifically, the use of the web to achieve this objective). These two intertwined research areas require an analysis through three dimensions – technical, social and behavioural – and these constitute our conceptual framework for the evaluation of the CHC.

Technical Dimension

This focuses on the CHC as an artefact, its representation of the context, its construction of the user, and its reconstruction of a professional knowledge base. It addresses and evaluates the aim of the CHC to facilitate electronic dissemination of these resources and other clinically relevant information, so that the information can be accessed whenever and wherever required. The evaluation will examine the useability of the system in terms of functionality, frequency of use, purpose of use, user satisfaction, user friendliness, time required to locate information, searching utility, success or failure of searches for relevant information, flexibility, and customisation. Training and support will also be examined here as we consider it an integral component of the CHC Program. Evaluation areas will include teaching and learning needs, critical appraisal skills, evaluation of teaching and learning, best practice teaching methods, training models, and the development of a tool kit for trainers.

Social Dimension

This focuses on the regional, institutional, professional and education context in which clinical practice occurs. It acknowledges the fact that the CHC is situated in particular social spaces and is attentive to those spaces. It addresses and evaluates the aim of the CHC to provide equity of access to critical clinical knowledge resources for clinicians in the public health care sector throughout Victoria. The evaluation questions will include the "who, when, where" as well as impacts of the CHC on accessibility of resources.

Behavioural and Professional Dimension

This focuses on the extent and character of the intersection or overlap of the CHC Program and evidence based practice. It addresses and evaluates the aim of the CHC to support integration of evidence based practice into the health care system. The evaluation will address the use of the CHC by clinicians and whether it met their information needs. We will identify knowledge resources, awareness of available resources, ability to access these, current usage patterns and factors influencing utilisation. The evaluation will also address any impact on decision making by measuring clinician change and examining the barriers/opportunities, any relevant forces at work, and strategies to positively influence behaviour.

This evaluation study will capture a broad range of contributions that the CHC may have made (and may continue to make) to clinical practice by using multiple and different evaluative criteria and gathering data from a variety of sources. The outcomes achieved by the CHC, and the impacts of this achievement on various professional groups, need to be analysed from a number of different perspectives (clinician, patient, manager, educator) and across a number of different dimensions (technical, social and behavioural). Priority will be given to analysing the impact of the CHC on clinician behaviour. It is important to emphasise that it is the clinicians who are in the strategic position to determine the frequency and nature of CHC use, and the implications of the CHC Program flow from clinicians' decisions and behaviour. The data collection, analysis and interpretation will recognise this important fact.

Methodology

Bearing in mind the aims and objectives of the CHC and the evaluation areas identified, the evaluation will address the following questions:

1. What research has already been conducted which might cast light on the implementation of evidence based clinical practice, and the design and use of health informatics systems?
2. What is the state of current practice and current attitudes among clinicians in relation to evidence-based health care?
3. What is the state of current practice and current attitudes among clinicians in relation to computer-based information systems?
4. Are the CHC's methods for presenting and delivering information meeting the specific needs and expectations of clinicians?
5. Are the knowledge resources provided by the CHC utilised in everyday clinical practice?
6. What factors are facilitating and/or impeding this utilisation?
7. What strategies are influencing clinical behaviour and choice of knowledge resources?
8. Is the information accessed through the site assured with regard to quality, validity and relevance?
9. Does the CHC work effectively with respect to state-wide communication of knowledge for clinicians?
10. Is the clinical knowledge equitably distributed across the state, taking the size and rurality of hospitals into account?
11. What changes occur in all of the above over the three year period of the evaluation?

Since the evaluation will involve technical, social and behavioural dimensions, data collected will be both qualitative and quantitative. To address the evaluation questions stated above, the following methods will be employed:

- Focus groups with medical, nursing and allied health staff
- Individual interviews with medical, nursing and allied health staff
- Direct observation of clinician access and usage of CHC and other information resources and utilisation of these resources in everyday clinical decision making practices
- Online log analysis of usage of CHC
- Paper based user questionnaire survey
- Online user survey

The three-year evaluation has been divided into four stages. The following provides an overview of the stages for the evaluation project.

Stage 1 Baseline Evaluation (0-12 months)

The first stage of the baseline evaluation comprises a paper based questionnaire survey, focus groups and interviews. Over 600 surveys have been distributed throughout Victoria. Participants for the focus groups and individual interviews have been recruited from six sites chosen to represent a range of size, rurality and level of enthusiasm and readiness (infrastructure and organizational processes) for the CHC. Participants have been recruited on the basis of whether they are medical, nursing or allied health staff and whether they are novice or experienced users of the CHC. The aim of this stage of the evaluation is to have a mix of professional disciplines as well as a mix of novice and experienced users of CHC.

Stage 2 Evaluation (12-18 months)

At this stage of the evaluation, data collected during Stage 1 (paper-based questionnaire survey, focus groups, interviews) will have been analysed and will be used to inform the Stage 2 evaluation. For Stage 2, three of the six original pilot sites will be re-evaluated after at least six months implementation of CHC. At each of these three sites, repeat focus groups and individual interviews will be carried out, in addition to online log analysis of CHC usage. In addition to the methods that were used in Stage 1, a number of additional methods will be used to collect relevant information. An online user survey will be developed based on the findings from the baseline evaluation. In contrast to the paper-based survey, this questionnaire survey will be administered online to users in participating sites. Users will be requested to complete the online survey when they visit the Channel. Another method will involve direct observation of clinician use of the CHC. The evaluation team will use a number of the evaluation sites to collect ethnographies of clinician use of CHC. This will involve close observation of the ways that clinicians use online information resources, including CHC, in their everyday clinical decision making practices.

Stage 3 Evaluation (18 -24 months)

Stage 3 evaluation will involve:
Continued online log analysis of usage of CHC
Continued online user survey.

Stage 4 Evaluation (24 -36 months)

Stage 4 evaluation will involve:
Final paper based user questionnaire survey
Continued online log analysis of usage of CHC
Continued online user survey.

Progress

Paper-Based Questionnaire

The first stage of the baseline evaluation comprised a paper based questionnaire survey (online). This survey has been provided to both users and non-users of CHC across Victoria. We focussed on both users and non-users of the CHC as we wanted to begin with how clinicians make decisions before investigating how clinicians use electronic sources of information for making decisions. Over 600 surveys were distributed across Victoria to 114 hospitals. Thirtyfive were sent to librarians while others were distributed through rural coordinators. Two hundred and thrity three surveys were returned. This survey will collect baseline data for the evaluation prior to the complete roll out of CHC state-wide. The responses from the survey provide primarily quantitative evaluation data which should inform and complement the qualitative data that has been collected in the focus groups and interview questions. The data entry has been completed and preliminary analysis has been completed.

Demographic Information about the Respondents

In all, 153 female and 75 males responded to the survey. The average number of years respondents worked in the health care profession was 18.65 years. Fifty-five allied health, 49 medical doctors, 102 nurses and 26 others (managers, administrators, etc) responded to the survey. A detailed examination of the survey results will not be examined in this paper. However we will examine one question from the survey: how do clinicians use information resources in making a clinical decision-making. This examination should provide an insight into the different types of resources utilised by clinicians. The table below gives the percentage of the 233 respondents that marked the box for each response. Respondents were able to check as many responses as they liked.

The top four resources used to:

- *guide current treatments* included: paper-based clinical guidelines and protocols, workshops/seminars, journals and consultation with peers.
- *assist with diagnosis* included: consultation with peers, textbooks, journals and academic-based websites.
- *check patterns of illness* included: textbooks, journals, consultation with colleagues and internet search engines.
- *confirm my actions* included: consultation with colleagues, paper-based clinical guidelines and protocols, workshop/seminars and textbooks.
- *refresh my knowledge* included: workshop/seminars, conferences, textbooks, journals.
- *access local information* included: staff meetings, local services directory, consultation with colleagues and workshops/seminars.
- for *background research* included: journals, academic based websites, internet search engines and computer-based journals.

How do you use **information resources** in your clinical decision making?

Information Resources	**Guide current treatment**	**Assist with diagnosis**	**Check patterns of illness**	**Confirm my actions**	**Refresh my knowledge**	**Access local information**	**Background research**	***Overall***
People Based								
Conference	61	18	21	45	83	36	42	*90*
Consultation with colleagues	70	59	40	83	52	55	28	*97*
Staff meetings	42	17	20	42	36	59	16	*84*
Workshops,seminars	75	30	29	52	85	45	44	*94*
Paper Based								
Clinical guidelines & protocol	78	33	26	60	54	28	34	*90*
Journals	73	43	41	43	72	21	66	*92*
Local handbook	27	15	12	23	20	32	9	*56*
Local services directory	6	3	2	6	6	59	6	*61*
Textbooks	52	58	46	49	73	9	57	*89*
Computer Based								
CD ROMS	30	18	16	18	35	11	30	*49*
Internet search engines	51	30	32	30	53	25	61	*75*
Academic based sites	55	36	29	32	54	18	65	*73*
Other internet sites	30	17	21	20	35	20	42	*59*
Clinical guidelines & protocols	52	23	14	39	37	20	30	*65*
Journals	53	29	27	33	50	15	57	*67*
Local handbook	13	9	4	10	11	21	6	*31*
Local services directory	4	2	3	5	6	36	3	*39*
Textbook	31	31	24	27	37	8	35	*49*

Overall *refers to percentage of respondents that use the information resources for at least one of the activities listed.*

Table 1: Information resources utilised by clinicians (doctors, nurses, allied health) to make a clinical decision

As seen from the above analysis clinicians carefully choose information resources appropriate for the function. Understandably there is an emphasis on consultation with colleagues to guide current treatments, assist with diagnosis, check patterns of illness, confirming actions and accessing local information. Electronic resources appear to be extensively used for background research as opposed to obtaining point of care information.

Focus Groups

Eight focus groups have been completed at a variety of evaluation sites. Participants for the focus groups were recruited from six sites chosen to represent a range of size, rurality and level of enthusiasm and readiness (infrastructure and organizational processes) for the CHC. The focus groups were conducted as open-ended interviews on targeted or focussed issues surrounding the introduction of computer-based resources to Victorian public hospitals. The sampling for the focus groups typically involved bringing together people of similar backgrounds and experience to participate in a group interview about major program issues that affect them. These were led by an experienced and impartial facilitator. The job of the facilitator was to guide the group discussion and ensure that all participants had the opportunity to put forward their views.

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A number of consistent questions were utilised throughout the focus groups by the facilitator. The following provides a brief summary of insights gained throughout the early stages of the focus groups.

Question 1: Is Evidence Based Health Care (EBHC) widely practiced in your work environment? Initially it was necessary for the participants to define EBHC. It was defined as:
'*Basing your decisions on published information or actual data*'.
Another participant suggested that:

> '*I think the clinical environment is very sympathetic to the practice of EBHC. I think that the tools of engagement for individual clinicians to use are difficult to use and I don't think – the EBHC movement has failed to appreciate the need to create a mechanism for engagement*'.

Question 2: What sorts of professional/clinical factors influence your clinical decision-making? Generally comments suggested that decision-making is currently based on peer consultation:

> '*We practice a lot of our decision making* [through] *consultation with peers. We're lucky that we have a big department, a lot of staff and we have a lot of peers and colleagues so we can bounce things off each other all the time as opposed to a smaller department.*'

This finding is consistent with the survey results which also suggest an emphasis on consultation with peers for many point of care decisions.

Question 3: Has computer use changed the way you work? How?
In one department that has computerised their clinical guidelines:

> '*People are quite familiar going to a computer to assist them in making a decision*'.

In this department, these computerised guidelines have also been useful to new staff:

> '*Junior medical staff who were perhaps a little hesitant about asking the consultant use it all the time – do I ask them again, how do I manage this simple fracture. You'll see them and they'll be often scrolling through it to not appear to be novices I suppose*'.

Question 4: In relation to online computer resources, do you use these kinds of information resources to support your clinical decision-making?

> '*People still tend to rely on people who are familiar and know how to use the system rather than learning how to use the system.*'

Some suggested that they wanted:

> '*Predigested information on specific topics that you encounter frequently in clinical practice...*'

Others wanted:

> '*a readers digest version, you want to know what to do and you want to know quickly...*'
>
> '*For unusual cases you want to be able to identify relevant literature and examine it yourself*'.

Question 5: Do you have any comments related to the Clinicians Health Channel?

> '*We have phone calls from people that used to work in the department that know about guidelines, say they are working in Bendigo or Shepparton or a rural hospital they'll ring up, its 3 o'clock in the morning I've got a such and such can you fax me or email me the guidelines because I've got a patient here with it. So rather than have to do it the manual way it would be nice for everyone to be [connected via an] intranet*'.
>
> '*Any web site [requires] minimum key strokes – like to get the information quickly. So even if our computers are slow or fast, if you've just got the function keys to get into certain things rather than accessing all the sub menus – short cuts*'.
>
> '*If it makes it easier for them to do their job they'll knock your door down to get to this. Some don't realise it; some are scared by just the technicality and the ease of use, the facility. They are used to being winners and I think you've got to play to their cultural strength...*'

Interviews

Interviews were structured around the themes of the study – in this case information needs, resources use and computer experience. The project interviews were semi-structured, with questions asked around the themes and opportunity for interviewees to discuss other related issues. This research project aims to explore the usefulness of the CHC, therefore, it is important that the research tools allow for exploration and do not limit participant responses unduly. Interviews allow for participants to be asked for detailed personal accounts. The use of an interview format can facilitate the collection of anecdotal information, allow for fuller responses by participants and the opportunity for unforeseen information exchanges to occur. Twenty-four interviews have been undertaken and are currently being analysed.

Preliminary Examination of Interviews

In the preliminary analysis of interviews there appears to be a number of consistent themes. In particular there were numerous comments on the applicability of databases for research as opposed to point of care information. For instance some databases provide background research whereas others provide specific point of care information. It is also a consistent theme that clinicians desire a 'readers digest' of pertinent information and that access to suitable computers would assist CHC usage. It is also suggested that informal training and support is more appropriate then formal large group sessions. Understandably, isolated rural clinicians also desire access to other professional colleagues or people resources. The use of a 24 hour help desk could provide assistance to the isolated clinician. A number of specific comments have been provided to exemplify these themes.

Posting Questions/Discussion Groups

> *'I suppose if there's one thing that could be added to an online server it would be posting questions. Where a professional dilemma, a diagnostic dilemma – so if you are remote and you are removed from colleagues and you can't just go to the residents quarters and discuss it with the registrar – you are able to put it online so you can discuss it with a hematology registrar within that system'.*

Different functions of Databases

> *'I think Medline is brilliant if you're doing a Ph.D. If you're doing your MD in an interesting area then it's very useful.'*

Corroboration in Decision Making

> *'The problem is... that ... there is always the risk that, guidelines are out of date the moment they are written and not every database is accurate ... I think its important that people realise that you need more than one resource. If you really do have a clinical problem you need to corroborate with several resources'.*

> *'Ultimately that's what a good single site is about. Where it can offer you two or three different opinions, so that you can be reasonably sure that the decision you're making is based upon current practice and evidence. Whatever is on there, there should be at least one or two different approaches for a problem. I don't trust any one person or any one thing; I need to have several approaches before I agree to anything'.*

> *'A patient I saw on the ward who was diabetic and had high blood pressure. I was asked to decide what sort of blood pressure medication to prescribe. I chose a particular type because of the recent trial that came out ... I guess I probably found that out at a clinical meeting first of all as opposed to a database..'*

Abstracts versus Full Text Journals

> *'Obviously access to the journals is important – okay I can access Medline but you only end up getting the abstracts, which is never really enough. To go that next step and have the full text for downloading is so important. A lot of cases that we see there isn't a lot of information available, like those stinging jellyfish here a few weeks ago and it took a long time to sort out what sort of jellyfish they were and what the best treatment was. Nobody could identify it, how do you find the person who can identify it. These are the things that smart technology should be able to overcome. The internet is the perfect way of doing it. ...So I think the future is very bright. It's an absolutely essential tool.'*

> *'...it takes so long to get to the information. I know textbooks; I know where they are. If it's something very esoteric I might go on the internet because I know you can find a wealth of information. I do find it somewhat arduous navigating through all the tiers'.*

Conclusion

Overall this paper has outlined our rationale, approach and evaluation strategies. Our project website (online) continues to update our latest findings in relation to the three year evaluation. Stage 1 of the evaluation has been completed. A number of methodological approaches have been utilised including questionnaires, focus groups and interviews. In particular the evaluation team have obtained an insight into what information resources clinicians utilise and how these are differentially utilised dependent on the clinical function. Both focus groups and interviews provided an insight into what clinicians desire at the point of care. In particular the use of predigested 'readers digests versions' of clinical findings appear to offer promise. Database resources that offer the ability to obtain an abstract as well as full text versions of appropriate resources need to be emphasised. Our next step has been to evaluate the CHC website and recommend additional functionality for the website. It may be appropriate to consider the use of frequently asked questions, a site map, discussion forums, a search button, and help. In addition the website should provide recommendations to professional groups regarding information needs and recommendations to novice and experienced clinicians. The use of web-based clinical scenarios is also being considered to reinforce navigation and use of the resources on the Clinicians Health Channel.

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AN ONLINE WRITING SUPPORT INITIATIVE FOR FIRST-YEAR INFORMATION TECHNOLOGY STUDENTS

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Abstract

A perennial difficulty for first year students – one often viewed by them as an unimportant annoyance – is the need to handle sources and cite correctly. Any serious institutional attempt to address this issue in an interesting way is an enterprise concerned with motivation, as well as curriculum innovation. This paper reports on a collaboration between language and learning staff and a Computer Science subject leader to develop a web-based tutorial which provides tools for students to use to develop, inter alia, skills in using sources. The tutorial seeks to provide online learning support for interpreting an IT assignment topic, extracting information from sources, and integrating the material into a report with the support of online lexical tools. The project's origins lie in the evidence from previous years' experience that first-year students find this a particularly challenging task.

Keywords

web-based learning, instructional design, information technology, academic study skills

Introduction

As Drury (1997) claims, to produce quality courseware which will develop students' writing skills, the two issues of "authenticity" and "integration of computer-based tasks" are paramount. To assist students to use referencing conventions appropriately, interpret assignment topics and respond to exam questions a web resource has been developed by Language and Learning Services in collaboration with the School of Computer Science and Software Engineering. The resource provides web-based activities which draw attention to the ways ideas are organized and presented in academic texts, with a special emphasis on the discipline of Information Technology.

For language and learning staff to feel confident that the materials were authentic, intensive collaboration with the subject specialist was essential. This involved actual assignment tasks, selection of student work and source texts to use as examples in the interactive exercises, and developing a suitable computing corpus for the concordancer, as outlined below. The students access the resource by clicking on a link on the subject page, they can see at a glance that all the tasks relate to their subject, and they can link back to a discussion forum moderated by the subject leader. They can also link to a language and learning site, the Online Student Resource Centre. A significant aspect of the collaboration was the discussion and consultation about the design of the website, and what the student group would find most helpful in terms of lexical tools. Formative evaluation of the web resource was provided by a project reference group, language and learning colleague peer review, CSE1200 tutor review, user surveys and a student discussion list. Summative evaluation of student learning outcomes is currently being conducted and will be reported in a future paper.

The Problem

Lecturer and Student Perceptions

At Monash University the subject leader of a first-year Information Technology subject, Computer Systems, observed a number of common areas of difficulty faced by students completing a research assignment and exams. These areas of difficulty were identified as using referencing conventions appropriately, plagiarism from electronic sources, interpreting assignment topics and responding to exam questions. The subject leader suggested a number of possible underlying causes of these difficulties. Most students seemed unfamiliar with referencing conventions which was particularly evident for electronic sources. This may in part be due to the nature of the subject – a dynamic technical subject for which books provide limited – and usually out-of-date information. Electronic sources were therefore the most common source of information for the assignment. The subject leader attributed an increasing emergence of plagiarism, at least in part, to the reliance upon electronic sources. It was common for assignments to be submitted with large chunks of plagiarised text linked by the occasional student comment and retaining the commercial style of the source material rather than the academic style of a report.

Overseas students, who comprise approximately 40% of the student cohort, had difficulty in understanding exactly what was required in both the assignment specifications and exam questions. A recurring problem with overseas students (addressed by the resource, but not dealt with in this paper) was the inappropriate presentation of prepared answers for exam questions from previous exams. It appeared that these students were not reading the question on the current exam carefully but were focussing on the use of similar key words from past exam questions.

Academic writing in Computer Science may be an unexpected surprise for the first-year students. Many first-year students, fresh from school, are only barely aware – if at all – that there are different sections of a research paper; that different citation styles exist; and, more abstractly, that knowledge is constituted differently in different disciplines?

Research in the more practical areas of Information Technology too involves consultation of web sources, which may be refereed journal articles, e-zines produced by corporations or simply advertising material. If students learn from models, as we assume they do, then they are exposed to a dizzying array, the questionable value of which may not be clear to them. Where they are required in their subjects to "evaluate" their sources, they may not be sure how to approach this, and lacking models in the texts themselves, may literally not have any idea how to integrate the sources into their own text.

Students undertaking Computer Systems were surveyed early in first semester 2000 about their perceptions of their research and writing skills in relation to the assessment tasks of the subject. Interestingly, only 17-18% of students thought that "using quotations in assignments" and "referencing – in assignment and bibliography" was difficult or very difficult. Only one-quarter of the students thought they needed help with these tasks. This flies in the face of the course leader's experience that every year students demonstrate that they do not understand the conventions or the reasons underlying them. This is a common experience in first year (Clerehan, Moore & Vance, 2000), partly produced by the conditions associated with Year 12 study. It may be hypothesised that, if new students across the spectrum of the "essay-writing faculties" are not well-equipped to deal with integrating sources, the first-year computer science and software engineering student is likely to be less so.

Other explanations for this conflict of perception are that students may be less focussed on the assignment (worth 15%) than the exam (worth 70%), or may have not wanted to admit difficulty. Perhaps a more plausible explanation is that many, coming in from Year 12, were either not aware of what referencing involves or thought it of little importance, based on past experience. After completing the assignment and receiving their mark, students are more aware – in a number of cases painfully so – that confusion exists in their minds regarding the precise task requirements.

Assessment of Referencing Problems

The perceptions of the subject leader that the act of referencing sources was a major problem were confirmed in the results of a survey conducted by the language and learning lecturer in conjunction with the subject lecturer. A sample of 30 reports was drawn from across all grades. A modified version of a diagnostic assessment instrument developed to create "a literacy profile" for a cohort of students by the Learning Assistance Centre at the University of Sydney was deployed (Bonanno & Jones, 1997). Our instrument was developed in close collaboration with the subject leader to reach a consensus on valued characteristics associated with the assignment topic. The assessment criteria were then categorised into three main areas: selection of source material, integration of facts and ideas from source material, and referencing conventions (see Appendix A). The criteria were rated on a scale of 1–4, where 1–2 indicated serious problems, an inappropriate response, and 3–4 indicated a predominantly accurate response, or in other words an appropriate response.

Overall, the results of the assessment indicated the selection of source material (A) presented fewer difficulties for students than the integration of information from source material (B) and the implementation of referencing conventions (C). The latter two criteria were rated as inadequately met in the majority of reports examined (see Appendix A).

	Frequency	
Criteria	No.	%
C. Presents the Bibliography and/or List of References using an appropriate format	22	73%
C. Presents correct in-text citation format (using Harvard or Footnote style)	18	60%
B. Clearly distinguishes facts and opinions found in the reference material from own views and assumptions	17	57%
B. Supports claims with references	16	53%
B. Presents summarised or paraphrased information appropriately to avoid plagiarism	16	53%
B. Uses appropriate academic language and style to present and discuss reference material	15	50%
C. Presents quotations in the text with quotation marks or indentation as appropriate	13	44%
A. Uses references relevant to the topic	12	40%
A. Uses references from a range of journals/texts	11	37%
A. Uses up-to-date references	10	33%
A. Uses references from a reputable source	9	30%
B. Integrates quotations into the discussion	8	27%
B. Selects appropriate information to quote	5	17%

Table 1: Frequency of criteria rated as inappropriately met

Table 1 shows the frequency of criteria rated as inappropriately met. The data indicate that the following of referencing conventions in terms of presenting a bibliography and/or a list of references (73%) and in-text citations (60%) were the most challenging aspects of citing for students. This may in part be attributed to confusion between in-text or footnote forms of citing; both options were provided to the students. As previously stated, a lack of familiarity with academic style in combination with the variety of citation models the students were exposed to in web sources may have also contributed to this result. These sources ranged from refereed journal articles to online magazines and even advertising material. Without explicit guidelines as to which model to follow, students appeared to make inappropriate choices.

Despite the majority of reports displaying an appropriate selection of references in relation to the criteria of currency, relevance, authority and a range of sources, there was a small percentage of reports with major problems due to either inaccurate citations in the bibliography or the absence of a bibliography entirely. The citation of web sites presented challenges to the students, with many students simply providing the URL for a site referred to.

Characteristics associated with the integration of facts and ideas from source material were identified as the next most frequent area of difficulty. These criteria were inadequately met in approximately half the reports. An inability to distinguish facts and opinions found in source material from the writer's own views occurred in 57% of the reports. This was primarily due to the absence of citations for sources referred to in a report. Related to this was the finding that 20% of the reports examined included no citations at all, although this was an integral part of the assignment. This accounts for the lower frequency of occurrence for the integration of quotations into the discussion (27%) and the selection of appropriate information to quote (17%), and contributed to the occurrence of plagiarism, in one of its many forms, in 50% of the reports. There was limited evidence in the reports of questioning the knowledge or opinions referred to; instead students presented information from source material as a statement of accepted fact. This may be a reflection of the style of citing which typifies the discipline (Hyland, 1999). However, it also concurs with the findings of Buckingham and Nevile (1997) in a study comparing the use of citations in 20 first year political science essays with that of experienced writers, suggesting that this may also relate to a lack of familiarity and experience with academic style.

Implications for the Design of the Tutorial

The assessment of referencing problems assisted in the planning and development of the tutorial by suggesting that the content of the study skills tutorial on *Using Sources in Assignments* should specifically focus on the implementation of referencing conventions and the integration of information from source material. More specifically the assessment appeared to indicate that referencing conventions, both in terms of the reference list and intext citations, needed to be explicitly modelled for a variety of sources; for example, monographs, periodicals and web sites. A clear distinction needed to be made between in-text and footnote forms of citing, possibly specifying a preferred style in the assignment description. Focus on the language of reporting and evaluating evidence, and explicitly defining plagiarism also appeared to be necessary to address the limited ability of many students to distinguish facts and opinions found in source material from the students' own views. Further areas of difficulty identified by the subject leader such as interpreting an assignment topic and responding to exam questions were addressed in other sections of the tutorial. An online mode of delivery was considered the most appropriate mode to meet the needs and interests of an audience of IT students, and also enabled the tutorial to be linked to the subject home page.

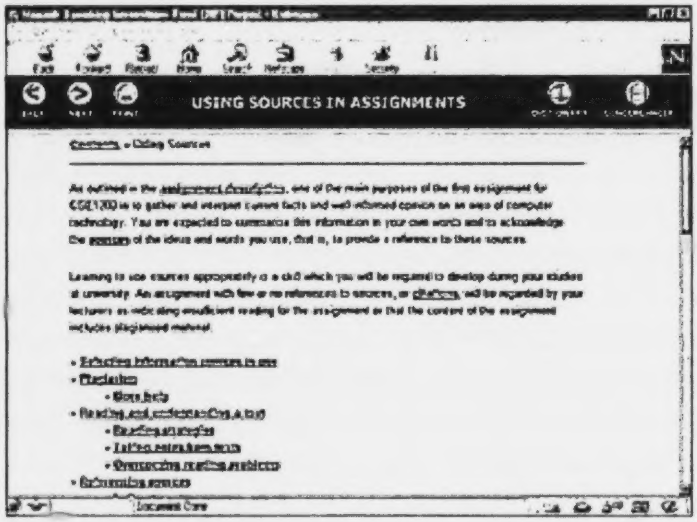
The Online Tutorial

Perhaps the most innovative aspect of these activities is the way in which lexical tools – three online dictionaries and a concordancer – have been integrated with a variety of activities to further develop effective academic study skills. The design of the web resource is centred around three separate academic study skills tutorials: 1. Starting the Assignment, 2. Using Sources in Assignments, and 3. Analysing and Responding to Exam Questions.

All tutorials are designed specifically to support first-year undergraduates enrolled in the Information Technology subject, Computer Systems. In this subject, students are required to complete a 1500-2000 word report assessing the current state of an area of computer technology, as their first assignment. The assignment requires students to consult recently published information from a range of periodicals or web sites and to consider the reliability and relevance of the information used. Students are explicitly instructed to summarise the opinion of experts in the field, acknowledge the sources of these opinions and to avoid plagiarism. As a measure to discourage plagiarism, students are instructed to attach an appendix consisting of photocopies or printouts of three of their most frequently used references.

The activities in tutorials 1 and 2 draw on authentic discipline-specific texts related to the assignment topic, relevant readings and student writing. The objective of these learning activities is to equip students with appropriate and "transferable" strategies for analysing an assignment topic, writing a report, extracting relevant information from sources, integrating this information into the student's text, and using appropriate referencing conventions.

The introduction to *Using Sources in Assignments* (see Figure 1) attempts to draw the students' attention to the importance of using sources appropriately and directs students to sections within the tutorial which address the referencing problems identified. The activities in these sections are supported by a range of online lexical tools which provide students with further models of referencing practice.



USING SOURCES IN ASSIGNMENTS

Contents » Using Sources

As outlined in the assignment description, one of the main purposes of the first assignment for CSE1200 is to gather and interpret current facts and well-informed opinion on an area of computer technology. You are expected to summarise this information in your own words and to acknowledge the sources of the ideas and words you use, that is, to provide a reference to these sources.

Learning to use sources appropriately is a skill which you will be required to develop during your studies at university. An assignment with few or no references to sources, or citations, will be regarded by your lecturers as indicating insufficient reading for the assignment or that the content of the assignment includes plagiarised material.

Figure 1: Using sources in assignments

The Deployment of Web-based Lexical Tools

The integration of electronic lexical tools with academic study skills activities was adopted in the web resource with the aim of facilitating the learner's concurrent development of fluency in writing, reading and referencing skills. Within the context of the primary focus on study skills development, extended activities were developed which involve exploring new vocabulary to develop a better understanding of word meaning and use in a variety of different contexts.

Online Dictionaries

Two online dictionaries were selected, for native and non-native speakers: the Macquarie and the Cambridge International. Access to a subject specific dictionary in the discipline of Computing was considered essential for students to examine terminology related to the field. A third online dictionary, Webopedia, was therefore selected for this purpose by the subject leader. Figures 2 and 3 illustrate the interface design for the integration of the online dictionaries within the tutorial. In the accompanying activity students are encouraged to read through the assignment topic on the left and explore whether they will get a better result from looking up a word in a general dictionary or a subject-specific dictionary. By encouraging the use of the online dictionaries a student is able to learn more about meaning – or disambiguate – and they can also compare discipline-specific meanings with general meanings.

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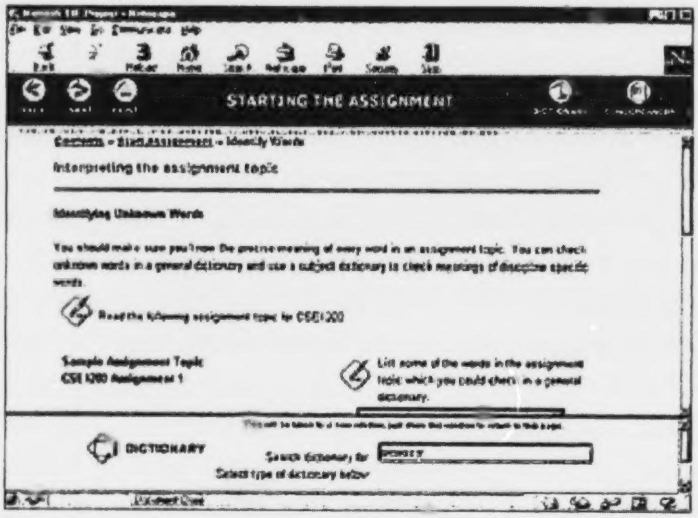

Back
Reload
Home
Search
Netscape
Print
Security
Stop
STARTING THE ASSIGNMENT
DICTIONARY

Contents » Start Assignment » Identify Words

Interpreting the assignment topic

Identifying Unknown Words

You should make sure you know the precise meaning of every word in an assignment topic. You can check unknown words in a general dictionary and use a subject dictionary to check meanings of discipline specific words.

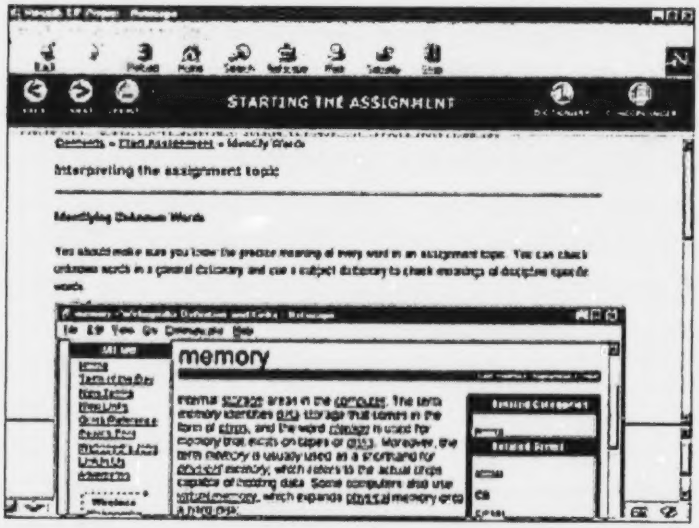
Read the following assignment topic for CSE1200

Sample Assignment Topic
CSE1200 Assignment 1

List some of the words in the assignment topic which you could check in a general dictionary.

Search dictionary for memory
Select type of dictionary below

Figure 2: Interface design for an online dictionary within the tutorial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Contents » Start Assignment » Identify Words

Interpreting the assignment topic

Identifying Unknown Words

You should make sure you know the precise meaning of every word in an assignment topic. You can check unknown words in a general dictionary and use a subject dictionary to check meanings of discipline specific words.

memory

internal storage areas in the computer. The term memory identifies data storage that comes in the form of chips, and the word storage is used for memory that exists on tapes or disks. Moreover, the term memory is usually used as a shorthand for physical memory, which refers to the actual chips capable of holding data. Some computers also use virtual memory, which expands physical memory onto a hard disk.

Figure 3: Interface design for an online dictionary entry within the tutorial

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The Concordancer

A concordancer performs the relatively simple function of searching texts in a corpus to find all occurrences of a selected keyword or phrase in that corpus. It can provide multiple examples of the different contexts in which a word is used. It is a very useful tool for language development as it enables systematic study of the meanings and use of words (including discipline-specific terminology) in authentic contexts (Johns 1991; Hadley, 1997; Milton, 1999). The use of a concordancer in our web-based learning resource follows the lead of Chris Greaves (1999) of Hong Kong Polytechnic University, who has developed an integrated platform for general English language learning in his Virtual Language Centre (VLC).

Using a similar approach to the selection of the online dictionaries for the tutorial, two corpora were established for use with the concordancer: a general academic corpus and a Computer Science corpus. Students are thus able to examine both discipline-specific academic English as well as more general aspects of academic English across a range of disciplines. The general academic corpus was compiled from selected academic English corpora from the ICAME corpus collection of American, British and Australian English. The computer science corpus was compiled from electronic academic journals selected in collaboration with the subject leader.

From previous experience in using a concordancer with students it was recognised that many students would be unfamiliar with concordance investigations, and would require clear guidelines on what to search for and how to analyse the concordance data (Stevens, 1991; Turnbull & Burston, 1998). The learning activities were therefore written with this in mind and provided implicit guidance as to the appropriate use of the concordancer. An online help tutorial to assist students to independently use the concordancer for their individual linguistic investigations was also provided for interested students to further investigate the use of the concordancer. Figures 4 and 5 demonstrate the concordancer interface and an example search generated to provide models of in-text citations and reporting language. The original source paragraphs for the concordance items identified can also be accessed by students to examine the context of a phrase.

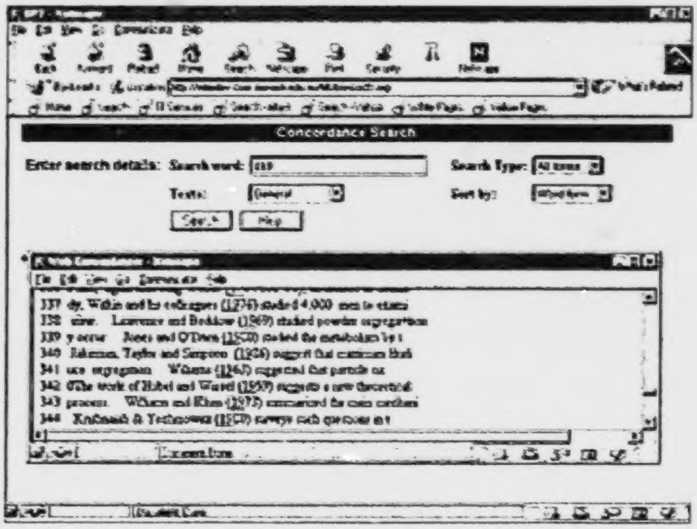

Figure 4: Interface design of web concordancer and overlay of example search

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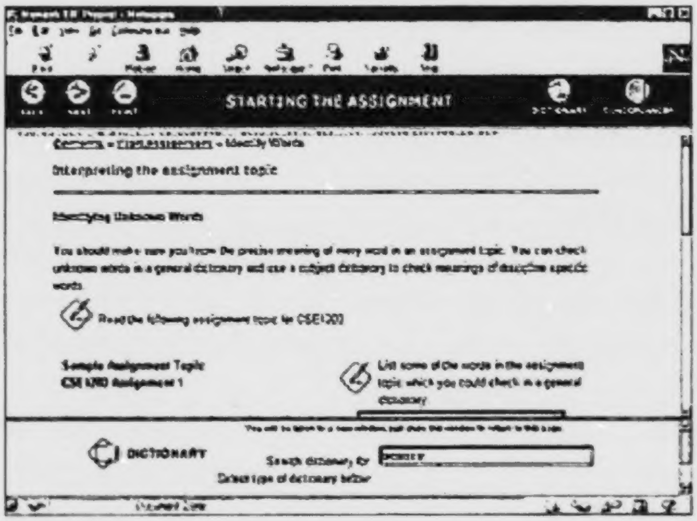

Interpreting the assignment topic

Identifying Unknown Words

You should make sure you know the precise meaning of every word in an assignment topic. You can check unknown words in a general dictionary and use a subject dictionary to check meanings of discipline specific words.

Read the following assignment topic for CSE1200

Sample Assignment Topic
CSE1200 Assignment 1

List some of the words in the assignment topic which you could check in a general dictionary

Search dictionary for

Select type of dictionary below

Figure 5: Context for selected concordance token

Conclusion

The collaboration of language and learning staff and the subject specialist has led to the development of a web tutorial which, among other things, addresses student uncertainty about selecting source material, implementing referencing conventions and integrating facts and ideas from source material. Although the specific content of the web tutorials targets first-year students enrolled in the subject, Computer Systems, it is expected that many other students will benefit from the learning activities, particularly those which focus on the integration of sources. Furthermore, as the lexical tools will also operate as "stand-alone" tools for self-directed language learning, it is expected that this innovative aspect of the resource will be of particular benefit to international and non-English speaking background students. In order for students to gain maximum value from the resource, it is important that the lexical tools are fully contextualised so that students can see how they can make use of them and become self-directed in other writing contexts as well.

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Appendix A:
Results of a Diagnostic Assessment of 30 First Year Computer Science Reports.

Diagnostic assessment of 30 first year computer science reports.

Criteria	Appropriate		Inappropriate	
%	(No.)	%	(No.)	
A. Selection of Source Material				
• Uses up-to-date references	67%	(20)	33%	(10)
• Uses references relevant to the topic	60%	(18)	40%	(12)
• Uses references from a range of journals/texts	63%	(19)	37%	(11)
• Uses references from a reputable source	70%	(21)	30%	(9)
B. Integration of Facts and Ideas from Reference Material				
• Selects appropriate information to quote	63%	(19)	17%	(5)
• Integrates quotations into the discussion	53%	(16)	27%	(8)
• Presents summarised or paraphrased information appropriately to avoid plagiarism	44%	(13)	53%	(16)
• Supports claims with references	47%	(14)	53%	(16)
• Clearly distinguishes facts and opinions found in the reference material from own views and assumptions	43%	(13)	57%	(17)
• Uses appropriate academic language and style to present and discuss reference material	50%	(15)	50%	(15)
C. Referencing Conventions				
• Presents quotations in the text with quotation marks or indentation as appropriate.	33%	(10)	44%	(13)
• Presents correct in-text citation format (using Harvard or Footnote style)	40%	(12)	60%	(18)
• Presents the Bibliography and/or List of References using an appropriate format	27%	(8)	73%	(22)

1. 20% of the reports examined did not include citations and are therefore not included in these figures
2. 3% of the reports included direct quotes only and are therefore not included in these figures
3. 23% of the reports included indirect quotations only and are therefore not included in these figures

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ADDING VALUE TO EDUCATIONAL MULTIMEDIA: THE ROLE OF GRAPHIC DESIGN

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Abstract

This paper presents an overview of the role of graphic designers in the design and development of educational multimedia. Three critical aspects of graphic designers' contribution to the design and development of educational multimedia are discussed including developing a visual concept, visual communication and developing conceptual ideas. An example of how graphic design has contributed to the educational value of a multimedia program, DNAexplorer, is presented.

Keywords

graphic design, conceptual design, educational multimedia, visual communication

The Design and Development of Educational Multimedia

An organised approach to the design and development of educational multimedia is vital as often considerable resources are invested to achieve an effective outcome (Phillips, 1997). Often a formal design and development cycle, such as the one outlined by Keppell (1998), provides a useful scaffold for the graphic design team. Such a design and development cycle outlines a number of development tasks, such as needs assessment, content collection, and story boarding, which are completed before substantive graphic design input. The completion of these tasks helps define the scope of the project generally and, as a result, contributes to the brief of the graphic designer. In addition the design and development cycle helps to define the graphic designer's role in relation to others within the development team (content provider, project manager, instructional designer, programmer and evaluator) which assists with the organisation and management of the development process generally. While these roles are not mutually exclusive, the definition of them often assists with communication about the project's design.

The Role of Graphic Designers

The graphic designer or design team can contribute to the development of an educational multimedia project in three major areas: (i) developing a visual concept, (ii) developing effective visual communication, and (iii) developing conceptual ideas. Graphic designers can draw on techniques used in traditional graphic field in each of these areas.

Developing a Visual Concept

The development of visual concepts has always been a part of traditional print-based graphic design (Lawson, 1990). It involves the graphic designer or team coming up with screen designs that organise and clearly present content to maximise users' understanding. In addition the design team attempts to develop a visual concept that is stimulating and appealing to the specific target audience. As Phillips (1996) says "graphic design or screen design provides the visual communication necessary to transmit a message in an attractive way" (p. 66).

Traditional graphic design frameworks have changed to accommodate the unique requirements of designing educational multimedia (Zeldman, 2001). These new requirements include working with programmers and information technology delivery experts to determine technical considerations that may impact on the graphic design. Programmers help to define the technical boundaries of an educational multimedia project. For example, an Internet-based project may have bandwidth limitations that may affect choices regarding the use of graphics and embedded objects. The designer may be required to restrict their use of large file-size graphics and embedded objects such as QuickTime and Shockwave. Similarly, graphic designers must learn to work with instructional designers, a role not often found in traditional design studios but often found in educational multimedia production. The instructional designer is responsible for developing the macro structure of the program and also must work with the graphic designer to ensure the concept, as determined by the content provider, is effectively displayed on-screen.

One change, which is obvious when moving from print-based media to multimedia, is the option to incorporate dynamic elements in the design. The use of animation and interactive elements in educational multimedia provides an additional challenge for graphic designers. First and foremost graphic designers must make judgements about the appropriate use of animation; does animation improve the visual communication of the concept? Traditional graphic design principles must be used when designing the moving elements of animations, which is not always an easy task. Designers must pay attention to the speed of animation and ensure that the most important elements of the animation are always prominent. A final aspect of the visual concept is interactivity. At a basic level the designer must not only design a navigation bar so that it is clear, consistent and intuitive but also plan what happens to the buttons when a mouse rolls over and when a mouse clicks. This is important because it alerts users that their interaction with the interface has taken place.

Visual Communication

Visual communication refers to the use of universally recognised visual aids and other techniques used to improve the readability and comprehension of text (Hamilton, 1970). Designing educational multimedia creates further challenges for graphic designers particularly given the end users of the program will often be unassisted. This places a greater emphasis on the need for the visual communication to be clear and intuitive. For example, when designing on-screen navigation tools, the buttons themselves and their functionality should, as far as possible, be immediately recognisable. Information buttons (eg. help and glossary) should be clearly distinguished from navigation buttons (eg. forward, back and home). The navigation options given to the user should be consistent, concise and clear, rather than presenting the user with a confusing array of (too many) navigational choices. It is often helpful, depending on the nature of the program, to give users an indication of where they have been and how far through a section or the program they have come.

The visual communication choices of multimedia graphic designers are affected by the technical specifications of computer screens. Graphic designers must learn to create clear or "clean" layouts within the tight confines of a computer screen as well as contend with the low resolution of computer screens compared with printed media (Phillips, 1996; Boyle, 1997). One example in this area is the use of on-screen text by graphic designers. Researchers have reported that users find reading from a screen more difficult that reading from printed material (Zeldman, 2001). Improving the on-screen readability of text is one of the primary ways in which graphic designers can enhance a project. Techniques to assist users with readability include, using short lines of text (8-10 words), "chunking" text into blocks on the screen, presenting topical blocks of text over a number of screens and maximising the contrast between the background and the text.

Conceptual Design

The graphic design field has always placed great emphasis on providing creative solutions to practical and conceptual problems. In the design of educational multimedia, the client or content expert will often present a practical or conceptual problem to the development team. In an educational context, this may be a concept students traditionally have trouble understanding or a practical problem associated with simultaneously providing students with access to a wide array of information.

Part of a graphic designer's role is to work with other members of the development team (instructional designers and programmers) to provide creative solutions to problems such as these. In this way graphic designers bring a particular focus and expertise to the design and development of educational multimedia. Often the "craft" aspect of graphic design is emphasised in discussions of graphic designers' role (eg. page layout, typography, illustration and technical drawing) (Doordan, 1995). However, another crucial role of graphic designers in the development of educational multimedia is to focus on the concept or idea behind the design. When faced with conceptual or practical problems, skilled graphic designers are able to generate conceptual ideas and use their craft to make these ideas an on screen reality.

DNAexplorer: A Graphic Design Approach

DNAexplorer, a multimedia program on bioinformatics, provides an example of how graphic designers are able to add value to the design and development of educational technology. Bioinformatics is an area of investigation that integrates the disciplines of biology, mathematics and computer science. Related activities include searching for, accessing and analysing biologically relevant information using a variety of desktop applications and web sites. Typically, students find it difficult to coordinate and integrate the use of these applications while maintaining focus on the relevant bioinformatics principles and procedures. DNAexplorer was developed to address these problems and its design employs a case-based approach. One of the primary aims of DNAexplorer was to provide students with navigational support as they investigated bioinformatics principles and procedures. The design of DNAexplorer presented a number of challenges for graphic designers in the areas described in the previous sections of this paper. The graphic design goals for the project were to:

- develop a "virtual" theme for the package;
- organise the content to maximise the readability of information; and
- provide students with a clear way of linking web sites and desktop applications.

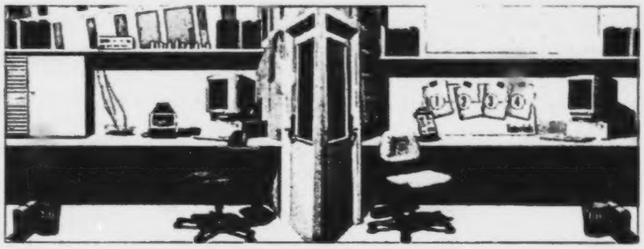

Figure 1: The virtual office and lab that formed the basis of the visual concept

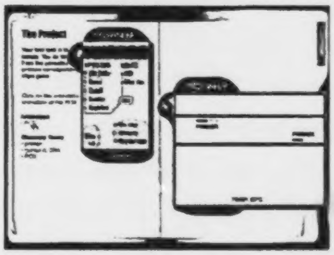

Figure 2: A screen from DNAexplorer showing the navFINDER and infoFINDER

With input from an instructional designer and a programmer, the graphic design team developed a virtual office and laboratory with the aim of creating a realistic environment for students (see also Kennedy, Judd, Keppell, Ginns, Crabb & Strugnell, 2001). This virtual office was developed as the home page for the program and formed the basis of the program's visual concept (see Figure 1). Students were able to access cases via manilla folders from the office. The manilla folder metaphor

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was carried through and used as an interface thus providing a consistent graphical theme throughout the package. The design of each screen in the package adhered to traditional graphic design principles, with modifications to suit on-screen presentation. For example, to aid with on-screen readability, text was "chunked" into blocks and presented over a number of screens and lines were kept short (8-10 words). White space was used to create clear demarcation between text and images or diagrams.

The content experts recognised the difficulty students had organising a pathway through desktop applications and web sites when investigating bioinformatics procedures. This became a practical and conceptual problem for the development team. In order to resolve this problem the graphic design and development team developed two support tools named the nav*FINDER* and info*FINDER* (see Figure 2). The names of these support tools and their appearance alert the user to their functionality. The nav*FINDER* was designed using the metaphor of a remote control and, as its name suggests, is used to find locations or applications. The nav*FINDER* allows students to navigate easily between cases, the office, the lab, web sites and desktop applications. It also provides students with text-based instructions about bioinformatics procedures associated with their case. The design of the info*FINDER* was based on a palm pilot. Again the role of the tool matches its design as students use the info*FINDER* to access additional information as they need it (eg. quiz questions, animations, DNA and protein sequences, glossary terms).

Conclusion

This paper has described the three critical aspects to a graphic designer's role in the design and development of educational multimedia. When reinterpreted for multimedia, traditional graphic design skills can add educational value to the development of multimedia programs. The example of DNAexplorer was used to highlight how the graphic design team worked with other members of the development team to develop a visual concept (the virtual office, lab and the manilla folder metaphor). This, along with the screen design, assisted with the visual communication of content. Finally, the graphic design team contributed to the solution of a practical and conceptual problem through the design of the support tools nav*FINDER* and info*FINDER*.

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RECOMMENDATIONS FOR TEACHING IN A DISTRIBUTED LEARNING ENVIRONMENT: THE STUDENTS' PERSPECTIVE

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Abstract

The University of Wollongong opened a new campus and two new access centres on the south coast of NSW, Australia, in 2000. The combination of distance with limited funding, after seed funding was expended, has provided opportunities to rethink teaching and learning strategies. Competition from traditional distance education providers in the area meant that, strategically, Wollongong had to "think differently". This paper provides an overview of issues identified by students through an evaluation of the inaugural year of a flexibly delivered Arts degree in a distributed learning environment. Actions taken by the University to resolve the issues are outlined and recommendations for implementation from the students' perspective are proposed.

Keywords

distributed learning environment, responsive evaluation, students' perspective, curriculum change, flexible learning

Introduction

In Australia a number of universities have set up national and international satellite campuses to broaden their student base through provision of better access to education (Cunningham, Ryan, Stedman, Tapsall, Bagdon, Flew & Coaldrake, 2000; Cunningham, Tapsall, Ryan, Bagdon & Flew, 1998; Davidson, Dekkers & Booth, 1994). The University of Wollongong has followed this path. It is a regional institution, located on the South Coast of NSW, Australia, which has expanded to include a centre in Sydney and an international campus in Dubai. In 2000, further expansion took place when two new access centres (at Bega and Batemans Bay) and the Shoalhaven Campus opened their doors to students. This initiative was funded by the Federal government with a view to using the latest developments in technology to support teaching and learning in rural areas.

Background and Context of the Study

The first year of an interdisciplinary Bachelor of Arts (Community and Environment) is the focus of this research. This new degree, developed over four years, is one of several degrees the University of Wollongong offers to students studying at the Shoalhaven Campus and at access centres in Bega and Batemans Bay. The degree has been designed to utilise a flexible learning approach in this distributed learning environment. Lecturers for the subjects were based at the Wollongong campus and local tutors were located at each of the centres. Students were required to attend tutorial sessions either once per week or once per fortnight for each subject.

An interdisciplinary degree suggests the blurring of the boundaries, drawing from the approaches of a number of disciplines, with the focus on issues and themes. This approach would for example use readings from a number of different disciplines; e.g. history, literature, philosophy (Rinn & Weir, 1984). When the degree was developed in 1998 there were only a couple of other degree specialisations within the faculty that were not firmly based in single humanities or social science disciplines (Albury, Lefoe, Littler & Trivett, 2001). The new degree required flexible teaching and learning methods to be incorporated in the subject design because of the distance to the new campus and access centres and the perception that technology could support teaching and learning in these new learning centres.

Subjects may be flexibly delivered in distance, open, distributed and campus based learning environments (Hedberg & Corrent-Agostinho, 2000; Taylor, Lopez & Quadrelli, 1996). For the Faculty of Arts academics developing subjects for the degree meant also thinking about the nature of a distributed learning environment, since the new access centres were a considerable distance from the Wollongong campus. The subjects incorporated teaching and learning strategies that the developers determined would best fit their subjects. For one subject this meant providing printed content material that incorporated student activities. These became the focus of the weekly tutorials with the onsite tutor. A WebCT site was also included that provided an overview of the weekly activities and a discussion space. Another subject provided online course materials that included lecture notes and a discussion space. Videos of the Wollongong lectures were sent to the centres each week and videoconference was used for the tutorials, with the tutor rotating visits to each centre.

The Bachelor of Arts (Community and Environment) was implemented in 2000 when Bega Education Access Centre, Batemans Bay Library and Education Access Centre and the Shoalhaven Campus opened their doors to the first intake of students.

Methodology

This initiative provides the context for an evaluation, which focused on the first year of implementation of a Bachelor of Arts (Community and Environment). An overview of issues from the preliminary analysis of the data focused on the student. A responsive approach which utilises a case study methodology (Stake, 1995) was used for this evaluation (Mark & Shortland, 1987; Guba & Lincoln, 1981). The responsive approach uses evaluation methods that are negotiated with the stakeholders who include students, tutors, lecturers and various members of staff of the institution. The methods chosen emphasise the issues, language, contexts and the standards of the stakeholders. Students were interviewed through focus groups and semi-structured interviews on two occasions during the implementation year, with two to six participants. Lecturers and tutors were also interviewed where possible late in the semester in which their subject was offered, although for some interviews this did not occur until the following semester. For the purpose of this paper the focus is on the student perceptions of implementation issues in their first year. Whilst the authors acknowledge the limitations of the small sample involved, the study can inform future research in the area.

Student Profile

There were a total of 29 students enrolled in Bachelor of Arts across the three campuses, including part-time and full-time students, with an age range from 19 to 60. The students at Shoalhaven Campus were predominantly post-secondary whilst at both of the other centres, they were predominantly mature-age students. Since this was the inaugural year for the degree there was much discussion amongst the developers about what the student profile would look like. An earlier report (University of Wollongong, 1996) had indicated that few post secondary students interviewed had indicated they would be attending a local campus as their preference was to leave home. Consequently the subjects had been developed with the view that the majority of students would be mature age. An assumption was made that these students would be highly motivated and self-directed. For many of the post secondary students self-direction and motivation may have been a problem (McInnis, James & Hartley, 2000). These students indicated a number of reasons for attending the campus including financial, family and work related, not being accepted at their preferred institution and because they wanted to do this particular degree since it was not offered at the Wollongong campus.

Issues in Focus for Evaluation

From a preliminary analysis of the interview data, key issues were identified as having significant impact on students in their first year. The researcher provided feedback to stakeholders as issues were identified so that action could be undertaken to resolve them. Whilst some of the issues were addressed, a report was given to stakeholders in October so that further actions could be identified to resolve outstanding issues.

Whilst it is recognised that many of the issues could be described as logistical in nature, the major themes have been identified as pedagogical, technological, support and administrative issues. These are arbitrary distinctions made for the purpose of clearer reporting since many issues overlap though it is recognised that all have some impact on student learning. Categories were determined through analysis of focus group discussions after the researcher identified major themes during stakeholder interviews (Stake, 1995; Cresswell, 1998).

Pedagogical issues and solutions

Many of the issues identified by students could also be identified in an on-campus learning environment, however location meant it was more difficult for students to find answers to their problems, especially when they didn't know who to contact.

Pedagogical Issues	**Students' Comments**	**Action**
Workload	I really didn't expect the workload to be as heavy as what it is for four subjects. (BB student). It was an inhuman amount of work (BB student). Well, I'm unhappy, I don't have a life. I don't go for a walk any more, I don't speak to my children… (BB student)	Ensure students are aware of two hours per credit point time commitment. Reduce enrolment eg. full-time to part-time
Student role	It's a different style of learning too, she's incorporating, not a lot of academic jargon going on, mostly chitchat and learning through discussion. (Bega student)	Clearly identify changes to student role in orientation.
Academic role	Students often interchanged the terms tutor and lecturer in the discussion and many were unaware of the role of the Dean, Sub-Dean and Associate Dean.	Clarify roles.
Learning community	I must say that (Centre Coordinator's) encouragement, when I rang up, …she sort of said 'Look yeah, I know it's hard. Don't give up. Don't give up'. Because I was thinking I could just bail out now before I fail, and so that, yeah...her support's great. (Bega student). That's another thing – time to spend with your teachers and discuss your work. We've had a couple of opportunities and I've found them to be really important and useful (BB student). I guess if you're on campus you can go knock on the door and say 'I don't get this idea can you explain it?' (Bega student). The other thing that kept us going was the fact that everyone else was saying the same so we didn't feel like such a freak (BB student)	Student support provided through coordinators, peer support. Informal communication with lecturers and other students through videoconferencing/ email/discussion space

Table 1: Pedagogical issues and solutions

Although much of this information was provided at orientation, students may have been overwhelmed by the information they received. A faculty handbook, "Studying on the South Coast", was produced to overcome some of the initial student problems. It identifies student and staff roles in this learning environment; provides information about accessing administration, subjects online, the library and introductory support for essay writing, using word processors and the coursework system.

Communication with lecturers who were based at Wollongong was identified as a difficulty but perhaps no more so than on-campus where "knocking on their door" is also restricted by availability of the lecturers for a variety of reasons including their increased workload. However, faculty-student interaction is identified as an important component of student learning (Kuh & Vesper, 1997) and can be addressed through the effective use of available technologies such as email and discussion spaces or making a specific time available for these students to phone lecturers.

The building of a learning community, where all members feel they belong and their contributions are valued, is also clearly important. Campus coordinators were an integral part of this development, as were the tutors and the students themselves, supporting each other with their learning.

Technological issues and solutions

Technology issues (Table 2) were a major focus for students in the discussion and varied from centre to centre.

Technological Issues	Students' Comments	Action
Computer access	It mightn't seem like much to ring her but when you're ringing long distance it is, and when you haven't got access to a computer, to email or anything, from Eden to Bega it's long distance. (Bega student) Student 1: And the web based stuff, I think my problem with it is having to download (and print)... because it's ten cents a page, if you don't have a computer, you can't leave it on there. Student 2: I found it a lot easier with the book last time... just give us the book (Bega student).	Extended access to computer labs out of hours. Provision of clear guidelines for assessment tasks and marking criteria. Provide hard copy of subject material when appropriate.
Training …	Things like using databases – I've just started to scratch the surface now and it would have been really good had I had those skills earlier. (BB student) I was impressed that I could learn it off the screen. (BB student)	Include skill workshops in orientation activities plus online training resources like the Database tutorial
Troubleshooting ..	Very often just when you really need this technology it just doesn't happen to be working… (BB student) It's really frustrating especially when you go in to print something. (Bega student) I love (the computer) at home now because my kids turn to me to fix things, whereas they taught me how to turn it on and get it going… six months ago I was almost computer illiterate, and now I'm the one that fixes everything on the computer. It's so cool. I love it. (BB student)	Monitor equipment performance; provide checklists for problem solving with equipment; further training for students; encourage peer support.
Appropriate use a) asynchronous discussion space	Student 1: The one good thing about the Arts subject was the bulletin board because it was compulsory to do it – to put 2 postings on per module and a module went for 3 weeks. And so in that way the bulletin board really got a good use. Student 2: It made you really read what you had to read, you didn't want to just put something really wishy washy on there and everyone else is going to read it and go from that you wanted to put something really substantial on there. Student 1: That's right. At the same stage in some of the subjects in the early semester, without having a reason to be on the bulletin board it's just died. (Shoalhaven students)	Set clear expectations in assignments. Provide a clear purpose for students to use the discussion space.
Appropriate use b) video-conferencing	I hate that audiovisual thing that's completing alienating. (Bega student) Someone would say something off the top of their head and someone would say we couldn't hear that. You would have to get the speaker and put it closer to them and so (they would) want you to repeat it. You'd like, oh you know, it did make it a bit just a little bit different. (Shoalhaven student) By the end I think you were just – you know they are there and it didn't really matter. (Shoalhaven student)	Provide student training for using videoconferencing during orientation; increase training to ensure pedagogical-sound methods used. Increase number of microphones at each campus.
Appropriate use c) video/audio lectures	The tapes are great … even in the other subjects they have tapes. (BB student) I actually find the lectures a bit useless – I have to say. And it's partly just because of the technology. The videotapes are often really, really hard to decipher and to hear what's going on… (Bega student)	Ensure high quality recordings through use of campus recording facilities.

Table 2: Technological issues and solutions

The majority of students at the Shoalhaven Campus indicated that computer training was not an issue for them as most felt that they were comfortable using the technology. Most of these students also lived within a reasonable distance to the campus though access to campus laboratories out of hours was an issue for them. Many of the students at Batemans Bay had access to computers at home and work and those who did not had extended access out-of-hours at the centre. Students in Bega indicated that most did not have computer access at home, in fact some had no electricity. Many had limited previous experience and for some, distance to the centre (up to 2 hours driving time) was an issue. Local Bega students used the 24-hour access at the centre.

Students were critical of how technology was applied in some of their subjects and were able to identify where it was used well (Table 2 – discussion space). The choice of appropriate technology in subject design is an important component in any curriculum. Video and audio recordings of Wollongong lectures were not produced professionally so the students found it difficult to focus on the content and frequently didn't use them. This was the response by some subject developers to reproduce a traditional learning environment because they did not come to terms with changing the teaching and learning strategies used in this new environment. Scott (1999) identifies that poor implementation support for innovation is often the reason for failure. He identifies implementation as the hardest part of change:

> "The context in which such programs are to be implemented is so complex and changeable that it is impossible to expect pre-packaged innovations to operate exactly as predicted, unless they are particularly simple" (Scott, 1999; p. 49).

Scott (1999) also suggests that staff support can be haphazard, that the timing can be poor or not practical. As a result, he suggests that staff may return to "old, safe, proven strategies" (p. 49) leading them to be disillusioned and less likely to become involved in further innovation. Two subjects in the first year involved faculty who took responsibility for the subjects of staff who had recently left or were on leave. They had not been involved with the development of the subjects, nor in the staff development activities that the developers had engaged in over the previous year. A team approach to subject development would ensure that the departure of a critical person would not have this impact on the subject.

Support issues and solutions

Support for student learning is identified in much of the literature as critical for effective teaching in any learning environment (Chalmers & Fuller, 1996; Prosser & Trigwell, 1999). The need for flexible access to resources and learning support is even more imperative in a distributed learning environment (Chalmers & Fuller, 1996; Fowler & Branch, 2000).

Support Issues	Students' Comments	Action
Student support	If someone could come and talk to us, if there was an adviser that we could talk to about it, computer problems, stress, big workload, maybe we could pop in a mini-bus and head up to Wollongong. (BB student)	Provide support through visits to centres, email, and videoconferencing.
Access to resources	When books are on reserve you can only sort of have them overnight … I'm only 30 km away but other people are about 50-60. (Bega student)	Electronic reserve initiative implemented plus increased online journal access. Library processes reviewed to extend reserve loans.
Career counselling	(I'd like to see) a careers person so you could sort of sit down and say well you know, if I do this where's this going to take me. (Bega student)	Provide support through visits to centres, email, and videoconferencing.
Learning support	It was quite good; it could have been better if it was scheduled (to meet our timetable). (BB student). He came down the day we had a big test - one for English on a Tuesday (Bega student).	Online and paper based learning support materials provided. Learning support embedded in 100 level subjects.
Academic advice	That would have been a good point to give to us at the start of it, like the start of 1st semester, just say look, these...these subjects that you'll be covering this year are very broad, just sort of like an introduction (Shoalhaven student)	Provide support through visits to centres, email, and videoconferencing.

Table 3: Support issues and solutions

At the University of Wollongong, learning support for students is provided through academic staff in Learning Development. Their approach of providing all students with assistance in making the transition to tertiary and discipline-based studies is an innovative and systemic approach to learning support (Skillen, Merten, Trivett & Percy, 1998; Skillen, Trivett, Merten & Percy, 1999). For this new degree, learning support was initially provided through workshops on such things as essay writing skills which many students did not attend because of timetable conflicts or other commitments. The provision of access to online support will mean that students can use materials when they require assistance. Future offerings of a core compulsory subject with embedded learning support will ensure that all students develop the skills required.

The decision by the library to initiate an electronic reserve collection meant increased access to resources for these students. Whilst the Shoalhaven students had access to their own library it was new and had limited resources. The Bega and Batemans Bay centres had their small collection stored at the local regional library and access was limited not only by the small number of resources but also by the opening hours. The electronic reserve collection meant that lecturers could provide readings, including single chapters of books to provide a much wider and up to date resource base for their students (Albury et al., 2001).

Visits to the centres by the Dean and Associate Dean to give academic advice provided visible support for students (and tutors) and modelled a practice they were encouraging teaching staff to follow. It also highlighted the importance they placed on the success of the centres.

Administrative issues and solutions

Administrative issues (Table 4) can be a major stumbling block for students at a distance from campus. A lack of email access can prevent a student from accessing key learning materials in the first week of session at a time when new students are nervous about their ability to learn in a new environment. Administrative systems that provide students with control and easy access to information about their enrolment can simplify the process.

Administrative Issues	Students' Comments	Action
Enrolment, subject changes, timetable changes	Many students commented in first few weeks about difficulties with these issues. (The timetable) was totally changed, it was totally different. (Shoalhaven student). It's a pretty big issue for us because I'm trying to work and support myself at the same time (Shoalhaven student).	Student Online system (SOLS) introduced and updated to allow students to make changes as required and to access up to date information.
Email accounts	First semester there were troubles with the bar codes, log on. Took us about 2 weeks. So that (was) really frustrating trying to work it out. And getting their account numbers and all this nonsense. That was a real shemozzle. They didn't work. (Shoalhaven students).	Online initiation system introduced Generic accounts established for subject access when email problems arise.

Table 4: Administrative issues and solutions

The University of Wollongong has in place an online student management system which now allows students to enrol, set up email and internet access, change subjects and personal details, access results, as well as a student inquiry centre.

Recommendations for Teaching in a Distributed Learning Environment

Factors influencing change in higher education have had a marked influence on how the student now experiences university, particularly their learning experience. This changing context has presented new opportunities for teachers to examine the way in which they teach and how learners learn (Biggs, 1999; Chalmers & Fuller, 1996; Ramsden, 1992). Whilst research in the area of student learning is relatively new there is a shift in the focus on teaching improvements to improving the ways that teachers can assist students to learn (Marton & Booth, 1997; Prosser & Trigwell, 1999; Ramsden, 1992).

Seven Principles for Good Practice in Undergraduate Education (Chickering & Gamson, 1987) provides some indicators of ways in which faculty can improve the learning experience for their students in on-campus environments. They include student-faculty interaction, peer interaction and cooperation, active learning, feedback, time on task, high expectations and respect for diversity and learning styles (Chickering & Gamson, 1987). These principles were later adapted in *Implementing the Seven Principles: Technology as a Lever* (Chickering & Ehrmann, 1996) which provides "cost-effective and appropriate ways" to use technology to advance these principles. The issues identified by students in this study bear remarkable resemblance to those principles, with the exception of perhaps administration which may not be seen as impacting on student learning on campus, or possibly the lecturers are further removed from it.

The issues identified by students provide the basis for some guidelines for subject design and implementation in a distributed learning environment.

1. Set me clear role expectations

Students indicated a need for a clear idea of time commitment required for each subject and reasonable workloads. Many students are working part-time or full-time and have family or other commitments. A recent study by Kember and Leung (1998) examined students' perceptions of workload. Where students perceive their workload as overly high it can lead to a reduction in class enrolments and has a negative effect on their learning. Although they point out that actual workload is difficult to measure with any precision, their research identified that when workloads are perceived as high by students they tend to resort to a surface approach to learning, that is they rote learn material. The converse was also true that when students rote learn material or use a surface approach to learning, they perceive their workload as high (Entwistle & Ramsden, 1983; Marton & Booth, 1997).

In a student-centred learning environment they also require an understanding of the changed role of students and their lecturers (Biggs, 1999; Ramsden, 1992). If students are to take more responsibility for their learning, as they are required to do in a distributed learning environment, then clear expectations must be set for all facets of their learning.

2. Talk to me

Although students had face-to-face contact with local tutors they also indicated that contact with the lecturer or subject coordinator was important to them. This could be supported through various communication technologies and when used asynchronously provide opportunity for students and faculty to respond at a time which is convenient to them (Pascarella, 1985; Kuh & Hu, 2001). Student satisfaction and development generally improves as the amount of contact they have inside and outside the classroom increases (Astin, 1993).

Laurillard's conversational model also suggests that students need feedback on the concepts they are learning (Laurillard, 1993). Although the tutors were providing this to some extent, interaction with the lecturer could also provide this feedback, though it could also be provided to some extent through automatic feedback in web-based self-testing, since prompt feedback is not always possible in a distributed learning environment.

3. Provide opportunity to work and talk with other students

Contact with students from other centres is also important when students are in small isolated groups but even at the larger centre students indicated that group-work provided an opportunity to get to know other students and facilitated a feeling of belonging to a community (Gabelnick, MacGregor, Matthews & Smith, 1990). Collaborative and cooperative activities are highlighted in the Seven Principles as increasing students' involvement in their learning (Chickering & Gamson, 1987). Information and communication technologies can support such activities as group work, study groups, and discussion of assignments where the students are separated by location.

4. Choose the best medium for the task at hand

The choice of the best media for the task is essential as well as ensuring that high quality resources are developed that meet the learning needs of students. Earlier research focused on the impact of different media used to transmit information rather than the nature of relationships or the nature of interactions or indeed the quality of the resources (see Jonassen, 1996). Clark (1983) initiated some interesting debate in his landmark paper that questioned the current research on conditions under which media influenced learning. He stated that 'media… are mere vehicles that deliver instruction but do not influence student achievement any more than the truck which delivers our groceries causes changes to our nutrition" (Clark, 1983). This issue continued to be debated in 1994 (see Kozma, 1994) and is still provoking debate today about whether researchers are asking the right questions (Ehrmann, 1997).

Determining the most appropriate technology to support learning can be a time consuming task for lecturers and students. When audio and videotapes are used they should be high quality recordings if students are to make use of them.

5. Teach me to use the technology

Although some training was provided for students in orientation week they indicated that they need flexible access to training. Although there is an expectation that many students have developed IT skills during high school, many of the mature age Shoalhaven students may not have used computers (Candy, Crebert & O'Leary, 1994). Moran (1995) identified that students require "support and training … in accessing and learning how to use ITs in the context of their study (p. 16). Barrakeet & Department of Education Training and Youth Affairs (2000) also identified from the literature that:

> productive use of CIT by students is achieved through the interaction of convenient and reliable access to 'front end' infrastructure, appropriate use (both by the student and the academic) of CIT which is part of a broader learning design, and reasonable support for this use by the staff, systems, infrastructure and processes of the University (Barraket & DETYA; p. 111).

Training students to use technology could be embedded in subjects to ensure that students develop the skills, as they are required. Computer based training packages and support will allow flexible access to meet student needs.

6. Provide resources I can use

Creating new library systems can be a challenge, not only within the university but also in terms of creating partnerships with local town libraries in order to provide students with access to information resources (McPherson, Curry & Humphreys, 1997). In one centre the local library had not yet moved to an electronic catalogue system and this not only limited students' borrowing but also restricted the support the library was able to provide students in accessing materials available electronically (Fowell & Levy, 1995). Students at the other centres were extremely positive about the library access but needed further skill development in using databases and electronic resources. Access to library and other resources can be extremely limited in isolated areas. Efficient and effective systems that support these students can be provided through access to full-text databases and electronic journals together with flexible borrowing systems (Albury et al., 2001).

7. Let me know what support is available

As the student profile has changed significantly in higher education in Australia since 1988 and the move to a mass education system, support services have been identified as critical to enrolment attrition (Promnitz & Germain, 1996). On-campus student support services are often well developed but may be difficult for non-local students to access or may simply not be used. Integrating learning support within subjects improves the skills of all students (Skillen et al., 1998). Visits to more isolated centres or the use of technology such as videoconferencing can be used for individual meetings with other services such as career development and counselling services. A student handbook which lists all support services and how to access them is also worthwhile.

8. Guide me through the administrative nightmare

Administration difficulties for on-campus students can be challenging and when they are removed from the campus the frustration levels are even higher. Administration should not be a nightmare if systems are in place to support students. An online administration system allows students to review and change their subjects, access timetables, and initiate their email accounts can simplify this process. A helpdesk facility is also essential to support remote students (Innovations in Distance Education Faculty, 1998). The report, *An Emerging Set of Guiding Principles and Practices for the*

Design and Development of Distance Education, suggests that students at a distance should have administration access that is at least as good as that available on-campus. We would suggest that they deserve a better system.

Conclusion

The inaugural year of any new degree is a challenge for students and staff alike. In a distributed learning environment the challenge is greater, particularly when everyone at the local sites is also new to the institution and how its systems work. The issues identified here don't portray the many successes achieved in this first year, or the hard work of all those involved in making this innovation a success. Nor do they portray the enthusiasm and dedication of the students to overcome the challenges they faced.

The University of Wollongong has used the lessons learnt from this implementation to develop more flexible teaching and learning practices at the Wollongong campus, the Dubai campus, and at international locations where the University currently has partnerships with other institutions. Whilst the current case study cannot be generalised to these other contexts, ensuring the key issues are resolved provides an opportunity to target other issues in teaching and learning for all students at the University of Wollongong.

Despite the early implementation issues, it is appropriate that the final words come from the students:

- I just think that it's a fantastic opportunity here, to be able to learn, it's just amazing.
- Yeah, it's great. I love it too. We're very lucky really; we've got it good.
- And we've got really good tutors; we've got a really good course.

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BRINGING VIRTUAL TEAM SKILLS TO UNDERGRADUATE BUSINESS SCHOOLS' STUDENTS THROUGH CROSS-CAMPUS COLLABORATION

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Abstract

National and international companies are now more truly national and international than ever. Information systems are converging, global intranets connecting far flung branches of a company are becoming routine, teleconferencing is moving to the mainstream, and virtual teaming is rapidly becoming a natural means for companies to best leverage internal expertise that is geographically wide-spread. To provide students with the tools to help these companies, colleges must begin to incorporate means for providing their students with both a theoretical and practical understanding of these information systems. This paper discusses a pilot project conducted between two campuses to provide students with an experience using virtual teams. The project is described in detail in this paper.

Keywords

virtual teams, videoconferencing, campus collaboration

Background

National and international companies are now more truly national and international than ever. Information systems are converging, global intranets connecting far flung branches of a company are becoming routine, teleconferencing is moving to the mainstream, and virtual teaming is rapidly becoming a natural means for companies to best leverage internal expertise that is geographically widespread. General Electric, as one example, is installing real-time collaboration tools to over 300,000 employees around the world as well as web applications that will connect thousands of suppliers and customers (Drucker, 2000).

For virtual teams to exist, they have to have a purpose, a collection of people and communication links (Lipnack & Stamps, 1999). The purpose is often to get a job done quickly (Chase, 1999). In order to function quickly and efficiently, virtual teams members need to be skilled in two areas, the technical and the human. Participants need to know how to use of various technologies including audio-conferencing, videoconferencing, email, chat rooms, discussion boards, smart boards, group calendars, and the like. Participants also need to learn how to communicate using technology, the lack of face-to-face encounters, as well as time zone, language and culture differences (Duarte & Snyder, 1999).

Virtual team leaders also have their unique challenges, as they are responsible for keeping the communication flowing. "The problem … (with virtual teams is) … usually some breakdown of communication. This is true in any group of people coming together; it's just exacerbated in a virtual environment" (Chase, 1999, p. 76). The lack of regular visual and nonverbal cues also inhibits the normal development of trust among team members. "Swift" trust may exist at the beginning but is often fragile (Jarvenpaa & Leidner, 1999). Setting clear expectations and being particularly concrete in defining tasks are two ways to foster trust in the ambiguity of cyberspace (Platt, 1999). Additionally, leaders are advised to keep the virtual groups small in spite of the electronic ease in expanding group size (Katzenbach & Smith, 2001).

Simply put, the importance and effective use of virtual teams has been identified as one of the "five imperatives" emerging from information technology that will force organizations to "change … structures, process and in human behavior" (Herman, 2001). As such, undergraduate and graduate programs in Management must begin to incorporate means for providing their students with both a theoretical and practical understanding of virtual teams. This paper discusses a pilot project conducted between two campuses to provide students with just such an experience.

Current Project

The current project will include approximately 125 University of Massachusetts undergraduate business students and two University of Massachusetts professors experienced in creating and implementing virtual teams by completing group projects involving students at two different campuses. The project will include using videoconferencing throughout the class including a final group presentation between the two campuses and a final paper. To develop the final project, students will use a variety of collaborative tools including email, a discussion forum, and chat. These presentations will then be saved for future reference. The authors will also create a website which will include a web-based tutorial on creating and conducting successful virtual teams.

The courses involved include an introductory Management Information Systems (MIS) class from Lowell (UML) and a Networking class from Dartmouth (UMD) (online). The premise for each project is that each team will have several members from Lowell taking the role of end-users and several members from Dartmouth taking the role of technical support. Each team will have a project where they have to contend with both a business and a technical component. The H. E. Butt Grocery Company: The New Digital Strategy (Dailey & McFarlan, 2001) will be used as the basis for this project. The teams in Lowell's MIS classes will be responsible for working with the business component. Each MIS class team will need to communicate (virtually) their technical support requirements to their counterpart team from Dartmouth's Networking class. The teams from Dartmouth's Networking class will be responsible for working out the technical components. Each full team will be required to use both synchronous and asynchronous tools throughout the semester and once at the end of the semester for the final presentation. A description of the research project guidelines can be found online (online).

We will use the Intralearn software system that is currently used by the University of Massachusetts of Lowell and this project will include a number of collaborative components. These components include:

Asynchronous components:

1) Email: sending email to all members of the group (with a carbon copy being sent to the instructor at their own campus as indication of use)
2) Discussion forum: group members respond to questions posed by the instructor, again using a class website created in Intralearn.

Synchronous components:

3) Chat: all group members must get together at one time (recorded in chat session such as Intralearn)

4) Mid-Project Team Status Report: each full team, half from Lowell and half from Dartmouth, will meet using the high speed Network (MITI) currently in place between the two campuses.
5) Final Presentation: students must show integration, at least by rotating between campuses on day or presentation. This final presentation will be made using the MITI Network.
6) Two lectures between campuses using the MITI Network.

Each of the instructors is teaching two sections of the same class during the Fall semester, 2001. This will allow us to vary the project slightly between sections. For ease of identification, we will call these Group A (the 10:00 section from UML and the 9:30 section from UMD) and Group B (the 11:30 section from UML and the 2:00 section from UMD). Group A will use all of the components described above since there are 45 minutes of overlap between sections every day. Group B will use all of the components except for the videoconferencing piece.

To evaluate the success of the project we will conduct two surveys. The first survey evaluates student usage of technical tools (email, chat, PowerPoint presentations, sending attachments, etc.) This survey will be conducted at the beginning and the end of the class to assess if there is any improvement. The second survey will be conducted at the end of the project. Questions will evaluate the success of the project. We will also be able to see if there are any differences between campuses, and between the two groups; that is, between the group that used videoconferencing and the group that did not.

We believe that business students must learn how to use collaborative learning and meeting tools. Using the tools across campuses forces students to use them as they are located too far apart to meet in the same place. With the Public University system in Massachusetts now operating on the same schedule, logistical issues in terms of class meeting times are reduced.

This project includes terminology and technology that is part of the course content, making it a perfect place to incorporate this project. Both courses are taught to similar cohorts – juniors in the business curriculum. Additionally, students will become experienced in working in virtual teams – an increasingly common reality in day-to-day business. We should gain some insights as to the importance of videoconferencing to virtual teams success. Students also get practice in working in diverse groups, and in both written and oral communication skills – common, stated goals across the University of Massachusetts system.

After the class is completed, a web-based tutorial on creating and conducting successful virtual teams will be developed. The tutorial will be based upon this project as well as a review of best practices for high-performance virtual teams. We will share a status report of this tutorial of "what we have learned" at the conference.

If this project is successful, it could be used as a model for teaching between any two Universities. Maybe next year we will set up teams between the University of Massachusetts and the University of Melbourne. Virtual teams are commonly used in business today, and there is not a better way to understand the difficulties and benefits in working from afar than personal experience.

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MINIMAL MARK-UP OF MULTIPLE CHOICE EXAMS USING XML

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Abstract

We describe a minimal XML mark-up for multiple choice exams. In our system, exams may be generated at anytime, by choosing a subset of questions from a pool. Furthermore, the system randomises the order of the choices within each chosen question. Thus a student may sit the exam many times. Our first version of this system has been described elsewhere. In this paper, we discuss the limitations of our first system that led to our current work, and give a description of the new system features, including XML tags for supporting collaborative authoring.

Keywords

learning technology, XML, multiple choice exam, online assessment

Introduction

A popular idea in pedagogy is the concept of assessment for learning (Biggs, 1999). That is, student learning is structured via assessment tasks. However, a small number of large assessment tasks, and final exams in particular, lead to stress and an unhealthy approach to learning, where the goal of students is to pass rather than to learn. This problem is alleviated if students are given many chances to pass an assessment task, thus removing the stress caused by fear of failure.

Another popular idea is criterion-referenced assessment (Biggs, 1999). In this form of assessment, criteria are specified for a "pass" and all higher grades. Students are assessed on whether or not they have satisfied the criteria. Traditional university assessment practice is norm-referencing, where students accumulate a final mark, which then may be scaled to a desired distribution, and final grades are assigned according to the scaled mark. Norm-referencing leads to quibbles over marks, particularly when a student is close to a grade boundary. It discourages healthy skill-focused learning.

The above pedagogical issues led us to conceive of the following assessment regime, for a single subject with very large class numbers (more than 500 students), occurring early in a university degree program. Students are assessed by small regular assessment tasks. Students work at their own pace. Each task is graded as either "satisfactory" or "not yet satisfactory" (the boundary between these grades is significantly higher than 50%). Students with the latter grade need to repeat the task until the "satisfactory" grade is achieved. An overall-passing grade for the subject is awarded when a student attains a "satisfactory" grade for all tasks comprising a core set. Higher grades are awarded if a student completes further optional tasks. Given the marking-intensive nature of the above assessment regime, each assessment task is a small exam of multiple choice questions (MCQs).

Other Systems

Many existing web-based assessment systems, such as Blackboard, WebCT, and TopClass, support multiple choice testing. However, they do so in ways that do not easily lend themself to supporting the above assessment regime. Some of these existing web-based systems support an exam that is "hard encoded" as a static web page. This static approach results in an exam that should only be administered once to a group of students, otherwise a student may memorise the correct answers, perhaps after discussion with peers. Existing web-based systems only support a limited capacity to present a student with a random subset of questions drawn from a pool. Also, entry of questions into these systems is clumsy.

The IMS Global Consortium (2001) has developed a standard language for describing multiple choice exams, using XML (Maruyama, Tamura & Uramoto, 1999). This standard is very large, with the IMS white paper running to 124 pages, and caters for many variations on the basic multiple choice theme. For example, it provides for graphical input/output, for MCQs such as *"Click on the location of Australia in the following image of the world".* Instead of the IMS design philosophy, which attempts to anticipate all possible future uses of the mark-up language, we have opted for a bottom-up minimalist approach: we only introduce new tags when we have a need for them within our own exams.

Our Version One System

To support the assessment regime we outlined above, we first developed a web-based system that used a pool of potential questions, marked-up in XML. We have described our first system elsewhere (Lister & Jerram, 2001). In that system, a student may sit an exam at any time, by going to an invigilated PC laboratory dedicated to that purpose. The markup of a single question, from a pool of questions, is shown in Figure 1. The "Stem", "Key" and "Distractor" tags are self-explanatory, and reflect standard terminology from the literature on MCQs.

```
<Stem>What colour is the sky?</Stem>
<Key>Blue</Key>
<Distractor>Red</Distractor>
<Distractor>Green</Distractor>
<Distractor>Purple</Distractor>
<Distractor>Burnt Orange</Distractor>
```

Figure 1: An XML mark-up of a single multiple choice question, within a pool of questions

```
<?xml version="1.0"?>
<Pool>
<Question>
<MUTEX>Mark-up of single question goes here, using the tags shown in Figure 1.</MUTEX>
<MUTEX>Mark-up of single question goes here, using the tags shown in Figure 1.</MUTEX>
</Question>
<Question>
Mark-up of single question goes here, using the tags shown in Figure 1.
</Question>
</Pool>
```

Figure 2: A framework for a pool of multiple choice questions

The framework for a complete XML mark-up of a pool of questions is illustrated in Figure 2. The "MUTEX" tag is an abbreviation of "mutually exclusive". A <Question> and </Question> pair may contain pairs of <MUTEX> and </MUTEX> tags. When selecting questions from the pool, the system selects at most one mutually exclusive element within any <Question> and </Question> pair. Thus the pool in Figure 2 can generate only two different exam papers containing two questions.

Limitations of Our Version One System

After completing this first system, however, we came to see that it had been a mistake to base the system around the concept of testing students in a dedicated laboratory. PC laboratories are an expensive resource. A single class of several hundred students could easily monopolise an entire lab.

We have come to the conclusion that the multiple choice exams should be run in a conventional class room, with students sitting at desks, using pencil and paper. A student presents them self to a clerk who runs the exam room. The clerk gives the student an exam paper, from a pile of such papers, which were generated (in the same randomised manner as in our first system) and printed earlier. Each paper bears a unique serial code. After attempting the paper, the student presents their answers to the clerk, who marks the paper against a marking scheme generated specifically for that particular paper. The clerk may then record the student's mark in a spreadsheet. The clerk need not have any training in the discipline being tested. Not only is this approach less expensive to run, it is probably more secure than our earlier web-based system, as it is not vulnerable to hackers.

Also, our conception of the role of XML has changed. Initially, the web was the focus of our project. XML was peripheral; it was a convenient way of marking-up MCQs. We have come to see XML as central to the project, as the language for "business-to-business" (i.e. academic to academic) transfer of an assessment resource. These changes in our thinking require the introduction of new tags, which we describe below.

Statistical Data

Over time, the steady improvement of a pool of questions will be driven, in part, by statistical analysis of the questions. For example, analysts commonly look at two groups of students: those whose performance on a set of questions placed them in the upper quartile of overall class performance, and those whose performance placed them in the lower quartile (Ebel, 1991). A single well constructed MCQ should be answered correctly by a large percentage of the upper quartile students, but should also be answered incorrectly by a large proportion of the lower quartile students. Such performance data should be included in the XML file. Figure 3 illustrates the tags we introduced to capture statistics.

```
<Stats>
<Where>Applied Epistemology Dept, Birdsville University</Where>
<When>Autumn Semester, 2001</When>
<UpQuart>80</UpQuart>
<LowQuart>20</LowQuart>
</Stats>
```

Figure 3: XML mark-up for statistical data on each key and each distractor

Version Control and Multi-Authoring

We expect that a pool of questions will be generated as a sharing "copyleft" (Dalziel, 2000) collaboration among academics, in different institutions, over multi-year time frames. This introduces two related problems. The first problem is the preservation of statistical data. A change to a question could render invalid all the historical statistical data about that question. The second problem is recognition of authorship: how does one distinguish between a small change to an old question, and the creation of a substantially new question? Academic sensibilities about authorship must be respected.

A <VERSION> tag may safely address both problems. An academic could change an existing question, but leave the original question in the XML file, and group the old question and the new question within <VERSION> tags. It would be understood that the first question within <VERSION> tags is the most current version. The function of this new <VERSION> tag is similar to the existing <MUTEX> tag.

Open Design Issues

Assessment-for-learning implies feedback. A student should be told why their choice for a particular question was wrong. Such information could be provided in the XML, for each distractor of each question. Its use, however, is problematic. The options presented to the student are a randomized version of the distractors in the XML file, so relating a student's answer to the XML is not straightforward.

Some MCQs will require formatting features to be added to our mark-up, such as facilities to ensure that elements of a stem/key/distractor align in a column. In a primitive and clumsy way, this can already be done, by embedding HTML tags in a MCQ, and then printing out the exam paper via a web browser.

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DOES EMOTIONAL INTELLIGENCE AFFECT SUCCESSFUL TEAMWORK?

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Abstract

There is a growing emphasis in tertiary education that students should develop professional skills as part of their education. Skills such as problem solving, communication, collaboration, interpersonal skills, social skills and time management are actively being targeted by prospective employers as essential requirements for employability especially in team environments. Of these, employment authorities consistently mention collaboration and teamwork as being a critical skill, essential in almost all working environments. How then can students successfully practice teamwork skills in tertiary institutions in order to develop these skills?

In this study, a group of final year multimedia students were investigated while completing a project-based unit, in which teamwork was an essential ingredient, couched in an authentic context. Student teams were required to develop web sites for "real" clients; with teamwork processes supported with on-line tools to monitor progress and contributions. At the end of the semester, successful and unsuccessful teams (in terms of collaboration and teamwork) were interviewed and surveyed to determine essential factors that promoted success. A framework was developed from the literature based on students' Emotional Intelligence, and propensity to engage in collaborative teamwork. It was found that there was a strong correspondence between students' Emotional Intelligence and team harmony.

Keywords
emotional intelligence, teamwork, higher education, collaboration

Introduction

Attributes needed for successful teamwork can be viewed from different perspectives, ranging in nature from "Visible to Invisible" (Figure 1). A team member, who is the programmer, must have acceptable technical skills in programming. This skill can be tested for competence, and classified as a "visible skill" (Wysocki, Beck, & Crane, 1995). Also, having acceptable generic and team skills is highly desirable but not always easily testable i.e. testing for time management, problem solving or collaboration skills can be challenging? Another skill set, known as 'Emotional Intelligence' (Salovey & Mayer, 1990) is increasingly being promoted as being necessary for successful teamwork. Emotional intelligence consists of five main elements - self-awareness, self-regulation, empathy, motivation and social skills which are difficult to test for, and certainly are not as "visible" as technical skills. How important are each of these skills for team harmony and success?

In this study, teams of final year multimedia students worked together to develop web sites for "real" clients. Online tools were provided which helped scaffold teamwork and collaboration. At the beginning of the semester, an online "Student Contract" was provided which enabled team members to commit to roles, deliverables, a schedule and amount of time committed, which was signed by all team members and tutor. This was complemented with online weekly journals completed by all students that showed success in completing tasks, as well as a self/peer mark for all team members based on task completion, quality, contribution to team dynamics, and punctuality at team meetings. These journals were completed online and confidentially submitted to tutors, who then used this information to conduct "Tutor Led Peer Assessment Sessions" to make decisions about transferring marks between students.

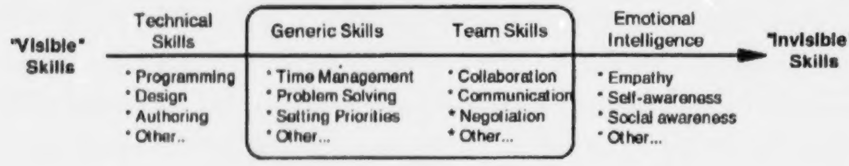

Figure 1: A spectrum of skills needed for teamwork

Twenty teams were involved in the project, from which two teams were investigated, one highly successful, and another, which had major collaboration problems and eventually was forced to split. These teams were interviewed, and comparisons were made to try and determine attributes that contributed to their success and failure.

Exploring Emotional Intelligence

The concept of emotional intelligence and its impact on teamwork is relatively new. Salovey and Mayer (1990) initially conceived the concept and coined the term Emotional Intelligence, which was derived from Gardner's (1983) theory of multiple intelligences. These included interpersonal and intrapersonal intelligence which were used by Salovey and Mayer (1990) to form the basis of the theory of emotional intelligence. Salovey and Mayer (1990) used this as a basis for their definition of emotional intelligence, which they define as the "ability to monitor and regulate one's own and other's feelings, and to use feelings to guide one's thinking and action" (p. 189). This definition identifies five main domains: knowing one's emotions, managing emotions, motivating oneself, recognising emotions in others and handling relationships.

Goleman (1998b) adapted Salovey and Mayer's (1990) model as a basis for his discussion of the theory of emotional intelligence and it's implications for everyday life including the world of work. He adapted Salovey and Mayer's emotional intelligence model to develop five emotional and social competencies: self-awareness, self-regulation, motivation, empathy and social skills. These are each discussed below.

Self-Awareness

Self-awareness is the ability to understand and interpret one's own feelings through internal reflection. The ability to be critical about thoughts and make changes to behaviour can lead to an in-depth understanding about one's self, which leads to a better understanding of others. Lanser (2000) places a strong emphasise on the importance of self-awareness in guiding and perfecting job performance, including interactions with colleagues and in the establishment of positive and productive leadership and teamwork skills. Team members need to be aware of their feelings as they may allow uncontrolled emotions to impact on the dynamics and culture of the team. Cherniss (1998) emphasises that effective team members are self-confident, which is reflective of their own emotional self-awareness, and ability to control their emotions.

Self-Regulation

Self-awareness of emotions enables team members to then practice self-regulation, which is the ability to use emotions to facilitate the progress of the task or the project (Goleman, 1998b; Lanser, 2000). Being able to regulate emotions especially during conflict, pressure, stress and deadlines facilitates the smooth progress of the project and promotes positive, effective working relationships with other team members and clients. Goleman (1998b) explains that handling emotions and putting the task first rather than emotions aids in the attainment of the required goal.

Motivation

Being able to motivate fellow team members into contributing their best is very powerful. Workers are discretionary in their application to a project – they will only give if they feel they are being supported, nurtured and inspired. Successful teamwork requires intrinsic motivation, persistence and vision. Team members are not only responsible for their own motivation but are also play a key role in motivating the team and colleagues. Goleman (1998b) and Lanser (2000) propose that motivation is an essential element of emotional intelligence that pushes us forward through the positive and negative aspects of working life by showing initiative, perseverance and dedication, as well as being goal orientated, focussed and proactive.

Empathy

Goleman (1998b) contends that empathy is understanding and interpreting colleagues' feelings and being able to identify with their feelings on issues through understanding their perspective and cultivating rapport with people from different 'walks of life'. Empathic team members have an awareness of the diversity of personalities and are accepting of the diversity of people and the impact culture can have on interactions within a team environment. Book (2000), defines empathy as the "capacity to see the world from another person's perspective" (p. 45).

Social Skills

Social skills are essential for the development of positive, effective relationships with colleagues and the ability to interact with team members to deter conflict, be aware of, ease and dissipate underlying tensions that can accumulate and have a negative impact on working relationships and project success. Team members need to be able to stimulate cooperation, collaboration and teamwork through well-developed social skills (Goleman, 1998b).

Teamwork and Social Interdependence

Teamwork is defined by Harris and Harris (1996) as "…a work group or unit with a common purpose through which members develop mutual relationships for the achievement of goals/tasks" (p. 23). Teamwork implies that individuals work in a cooperative environment in the interests of a common goal by sharing knowledge/skills and being flexible enough to serve multiple roles. The literature consistently highlights that one of the essential elements of a team is its focus toward a common goal and a clear purpose (Fisher, Hunter & Macrosson, 1997; Johnson & Johnson, 1995, 1999; Parker, 1990). Many organizations rely upon successful teamwork to achieve goals and to meet the needs of clients. It is a synergistic process that relies upon all team members to contribute and participate in order to promote and nurture a positive, effective team environment. Team members must be flexible enough to adapt to working in a cooperative working environment where goals are achieved through collaboration and social interdependence rather than individualised, competitive goals.

Social interdependence refers to how individuals interact in cooperative learning or working situations, including team environments and is an integral part of cooperative learning. The relationship between successful teams, cooperative learning theory and social interdependence is strong (Johnson & Johnson, 1999). "Social interdependence exists when individuals share common goals; each individual's outcomes are affected by the actions of the others" (Johnson & Johnson, 1995; p. 206). The literature consistently highlights interdependence focussed toward a common goal as an integral element of an effective team (Fisher et al., 1997; Johnson & Johnson, 1995, 1999; Parker, 1990). Scarnati (2001) explains that teamwork that relies upon cooperative processes enables individuals to extend their boundaries and achieve more through social interdependence than as individuals. "The team has synergy. By sharing a common goal or vision, the team can accomplish what individuals cannot do alone" (p. 6).

Social interdependence can be considered to be positive, negative or non-existent (Johnson & Johnson, 1999). Johnson and Johnson (1995) explain that positive interdependence creates promotive interaction in which individuals encourage and facilitate each other's efforts to attain team goals, such as creating positive relationships and collaborative team environments. Negative interdependence or competition generally results in oppositional interaction. This occurs when individuals prevent others from achieving because of their own competitiveness. Rather than promoting a team environment through positive interaction, team members are focussed on "...increasing their own success and on preventing anyone else from being more successful then they are" (Johnson & Johnson, 1995; p. 212). No interaction occurs when individuals work independently without interacting with others. Individuals focus on increasing and improving their own success and have no regard or interest in the efforts of others (Johnson & Johnson, 1995).

Johnson and Johnson (1995, 1999) list essential attributes of positive interdependence needed for successful teamwork as follows: giving and receiving help and assistance for both task related and personal issues; exchanging resources and information; giving and receiving feedback on tasks and teamwork behaviours; challenging each other's reasoning; encouraging others to achieve; influencing each other's reasoning and behaviour; using interpersonal and social skills to enhance team work; and consciously reflecting on the effectiveness of the team to continue improvement and acknowledge achievements.

Team members need to be aware that negative behaviour can impact on work productivity and affect the overall success of the team and project. Conflict resolution and the ability of team members to deal with issues, feelings and emotions can impact greatly on the success of the team. Team members caring for one another, encouraging each other, showing empathy and regulating their emotions contribute to and have an impact on the success of the team. Harris and Harris (1996) explain that successful teams have a high level of maintenance and must incorporate essential 'invisible' skills such as caring for one another, showing warm feelings, friendliness and offering team members support when needed. Successful teams require both technical skills and interpersonal skills "...communication at both the cognitive and feeling levels is what determines the success or failure of the team" (Harris & Harris, 1996; p. 29). The importance of cooperative, positive interaction team environments and a discussion of the essential elements of successful teams and determining a link to emotional intelligence theory is the focus of this paper. The following section provides a synthesis of emotional intelligence literature and aims to provide links between successful teamwork and emotional intelligence.

Emotional Intelligence and Teamwork

From the above review, it was found that there was much commonality between successful teamwork and emotional intelligence. This is supported by Yost and Tucker (2000) who promote a strong relationship between successful teamwork and emotional intelligence and contend that emotional intelligence competencies are more important than the "Visible skill" set shown in Figure 1, such as technical competencies. There is more to effective teamwork than a keen intellect and grasp of technical knowledge. The difference between success and mediocrity in working relationships, especially in a team environment, can be attributed to a team member's mastery of the softer skills – abilities and approaches grounded in emotional intelligence. (Grossman, 2000; Tucker, Sojka, Barone, & McCarthy, 2000).

Positive, effective interpersonal relationships are an important element of successful teams. Emotional bonding that exists between team members has a profound effect on the work produced and the overall success of the project. Teams that care about each other at a personal and professional level are more likely to be successful than teams that ignore the importance of the relationship between positive interpersonal relationships, professional relationships and goal achievement. Developing positive relationships where team members are aware of the impact their emotions can play on the effectiveness and success of the team should be the aim of each team member. A positive emotional climate should be developed so that all energies can be focussed on the attainment of mutual goals including the success of the project (Johnson & Johnson, 1999).

In order to promote positive, progressive, effective working environments, team members need to have a combination of technical knowledge and well-developed emotional intelligence including self-awareness, empathy, social awareness and be highly motivated and be able to inspire and motivate their colleagues. Table 1 links the attributes needed for successful teams with the emotional intelligence competencies defined by Goleman's (1998a) - self-awareness, self-regulation, motivation, empathy and social skills. These relationships were derived through a synthesis of the literature (Esquivel & Kleiner, 1996; Francis & Young, 1979; Harris & Harris, 1996; Johnson & Johnson, 1995, 1999; Yost & Tucker, 2000).

	Definition	Relationship to Successful Teamwork
Self-Awareness	The ability to recognise and understand your moods, emotions, and drives, as well as their effect on others	Having positive and productive teamwork skills Controlling emotions and understand the impact of emotions on the team Being self-confident, high self-esteem and a coherent and integrated self-identity Promoting psychological health including a happy disposition
Self-Regulation	The ability to control or redirect disruptive impulses and moods The propensity to suspend judgement – to think before acting	Being self-aware of emotions to enable self-regulation Handling emotions and putting the team task first Using emotions to facilitate the progress of the project Regulating emotions during conflict, pressure, stress and deadlines Coping with stress, frustrations through creating and contributing to caring, supportive relationships
Motivation	A passion to work for reasons that go beyond money or status A propensity to pursue goals with energy and persistence	Motivating other team members to contributing their best Openness, flexibility and motivation to change, innovation, creativity and collaborative problem solving Creating an environment that stimulates, enhances and empowers team members to become motivated and apply themselves fully Showing initiative, perseverance and dedication, goal orientation & focus Placing team or common goals ahead of individual goals and pursue these with determination and perseverance Having a sincere interest and motivation for the group and individual's achievements and goals Considering team morale and aiming to maintain a positive productive work environment
Empathy	The ability to understand the emotional makeup of other people Skill in treating people according to their emotional reactions	Understanding, interpreting and identifying with colleagues' feelings Cultivating rapport with people from different 'walks of life' Having the potential to turn adversarial relationships into collaborative alliances Showing emotional concern including reassurance and caring for other team members Helping to create a team environment where members can express their feelings
Social Skill	Proficiency in managing relationships and building networks An ability to find common ground and build rapport	Creating a team culture which is supportive, informal, comfortable, and non-judgemental Developing professional as well as positive personal relationships with other team members Developing intense, short-term relationships and being able to disconnect and work in another team environment with the same sincerity and motivation Being able to stimulate cooperation, collaboration and teamwork through well-developed communication and social skills Developing positive, effective relationships with colleagues through fostering trust, confidence and commitment Helping to establish a positive team climate and promoting support and respect for one another Having the ability to interact with team members and deter conflict, be aware of, ease and dissipate underlying tensions

Table 1: Emotional Intelligence (modified from Goleman 1998a) and attributes of successful teams

Case Study

Final year students enrolled in the Interactive Multimedia course at Edith Cowan University are required to develop skills and expertise in managing the development of multimedia product. The unit IMM "Project Management Methodologies", uses teams of four or five students to develop a web site, in which students use their specialist skills within a team environment. Team roles include programmers, graphic designers and project managers. There were 82 students completing this unit, which was delivered through a custom built web site to enable both internal and external students access to resources, and also to enhance the quality of the learning environment. The unit consists of thirteen, three-hour class sessions conducted over a full semester.

Students were required to carefully consider their own and their peers' contributions each week through online journals that allowed team members to rate their own and their peers' performance confidentially online. These proved to be successful in helping tutors make decisions about transferring marks amongst team members.

Within this scenario, one team was highly successful in developing quality work, without any team problems. Their journal entries continually reflected positive comments about other team members, and at no stage during the semester was there a request or requirement to transfer marks from one team member to another. The students were always goal focussed, continually exploring expectations of the tutor and the unit requirements. This team had a strong sense of collaboration, and were content with their peers work.

Another team experienced problems, causing it to become dysfunctional and had to be split. By monitoring the online journals, team discrepancies were identified and marks were transferred between team members, though resentment amongst team members continued to escalate. The tutor had several meetings with the project manager and individuals to help resolve issues, but to no avail. At one of the team meetings a serious disagreement occurred, in which one of the team members verbally berated another, from which point there was no reconciliation. After this altercation, team members felt they could no longer work together, so even though they would experience a heavier workload, they unanimously agreed to split and form two separate teams.

One week after the team split, focus group interview sessions were organised. A questionnaire was developed based on Goleman's work (1995, 1998a, 1998b) with a view of determining aspects of emotional intelligence present within each of these teams. The interview sessions were taped and transcribed for analysis. A summary of the results is shown in Table 2, which illustrates each of the five emotional intelligences, as described by Goleman (1995). By looking through the responses given by each of the teams, it is evident that the successful team had a strong awareness of the impact of emotions on team success. In almost all of their responses, this team was highly focussed on delivering a quality product, and not pre-occupied by personal issues that could interrupt their objectives. Focussing on a common goal is an important element of positive interdependence. The team members felt that they had a responsibility towards the other members of the team and that the success of the project was based upon each team member's contribution. They recognised that team members had different personalities and experienced problems at different stages. They felt that it was a "healthy thing" to discuss and offer constructive help/criticism in trying to resolve problems. They were strongly aware of the consequences – the negative effect on the team and their common goal – if emotions were not controlled.

The results from the dysfunctional team showed a lack of emotional intelligence skills, as defined by Goleman (1995, 1998a, 1998b). Team members seemed unaware and very surprised that they had upset other team members. Comments made by team members indicated that peers were inconsiderate of their situation and problems, and were not inclined to discuss problems, as they would only attract criticism. This resulted in team members resenting each other, which eventually caused major disruption and caused the team to split. There was a lack of communication resulting in problems affecting the development of positive interaction based on positive interdependence. Rather than the team as a whole having ownership of the project one team member felt that he was not included in decision-making and did not receive all communication regarding the progress and development of the project leading to miscommunication and resentfulness. This caused a lack of team cohesion and cooperation, a feeling of disempowerment, and resulted in the eventual split of the team.

The data showed the dysfunctional team having oppositional interaction or negative interdependence (Johnson & Johnson, 1995, 1999). Some team members were highly competitive and this negated the development of a synergistic team environment. After analysing the data it was obvious that negative interdependence was not the only reason for the dysfunction of the team; the lack of emotional intelligence was the main reason for the team being unsuccessful.

An individual student questionnaire was also given to all of the team members in both teams, after the focus interview questions. Students were asked to fill out a Likert scale based on questions related to Goleman's (1998) five emotional intelligences. An average of all the scores was taken to compare how students rated themselves against their peers. As shown in Figure 2, the functional/successful team clearly outscored the dysfunctional team in their responses.

They rated themselves and their peers highly, showing a marginally higher score for their peers, over their own. Whereas, the dysfunctional team, showed overall lower scores, and ranked their own/self emotional intelligence scores higher than their peers. This indicates that the dysfunctional team recognised that they did not have strong emotional intelligence attributes, though on average considered self better than their peers. This may be related to some of the "unconscious" miscommunications uncovered through the interviews i.e. these students *truly* believed that they were showing consideration toward others, but their peers did not perceive it this way.

By analysing the summarised interview and the survey results, it was evident that students in the dysfunctional team had lower skills in self-awareness, self-regulation, motivation, empathy and social skills. The in-depth interviews revealed clear differences between the two teams in these areas, which had a major impact on the quality of the final product and functionality of the team. In this study, it was clearly evident that a lack of emotional intelligence skills such as taking issues personally, not being aware of others feelings, not controlling feelings and others shown in Table 2, directly contributed to the team becoming dysfunctional.

	Functional Team	Dysfunctional Team
Self-Awareness	Team was aware of their emotions and the possible impact they could have on the team Team members tried to sort out problems as soon as possible by trying to be aware of others problems	Team members seemed unaware of the impact their behaviour had other team members When problems occurred teams members tended to take it personally Team-members didn't predict that comments would upset others
Self-Regulation	Team was product focused, and regulated their emotions so that they did not have a negative impact on the product The team facilitated the smooth progress of the project and promoted positive working relationships with team members to get the job done	Team-members did not realise they had upset peers, and didn't seem to understand the effect the emotional outburst had on the rest of the team Team members didn't control their emotions well under pressure and reacted quickly to trivial situations In communicating problems, team members were overly emotional and personal
Motivation	Team members felt comfortable and supported in discussing their problems The team created a positive and motivating team environment. They tried to motivate team members with constructive criticism The team was very goal oriented and focused on the "big picture"	The team didn't create an empowering environment, to allow all members freedom of expression and encouragement to contribute Team members lost motivation, especially when their work criticised in a negative fashion
Empathy	Team members had previously worked with others and knew when others were getting upset, which helped to deter conflict Team members felt supported in discussing their problems Team members respected different personalities, cultures and sensitivities	Could see that a team member was angry and upset, but didn't make any effort to try and understand why the team member was angry Some team members were aware of each others feelings, particularly when some were getting upset Team members considered others inadequacies as "downfalls" rather than something they could help them with The team didn't consider everybody's needs during planning sessions Some team members felt alienated and didn't feel part of team
Social Skill	The team never took issues in a personal manner, as it would detract from developing a quality final project The team felt that talking about or communicating problems to each other was a "healthy thing" The team felt that developing a healthy working environment with good relationships was important. They often socialised together	Lack of communication was evident in the team. For example, some team members believed that were making allowances for different learning styles, but this wasn't perceived that way The team did not communicating their feelings, which resulted in resentment and bad feelings to others

Table 2: "Comparative" Emotional Intelligence data summary

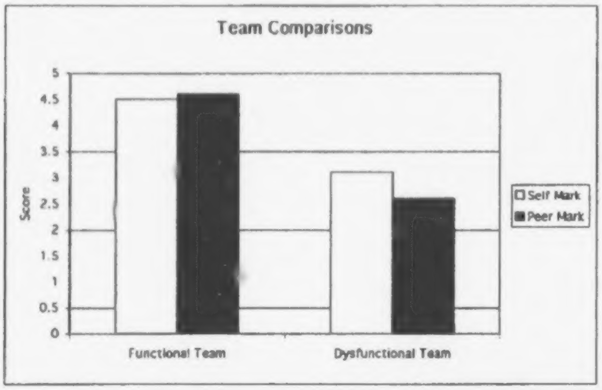

Figure 2: Comparing likert scale survey data

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Summary and Conclusions

This study analysed the team dynamics of a successful and dysfunctional team. The successful team was highly motivated to produce a quality product, and not pre-occupied by personal issues. This team felt that it was appropriate and healthy to discuss problems as they arose so that the final product would not be compromised, and they could get on with the job. This team displayed characteristics of positive interdependence and promotive interaction. However, the dysfunctional team demonstrated negative interdependence, poor communication, lack of consideration, empathy and understanding.

Using the attributes provided by Goleman (1995, 1998a, 1998b), it was evident that team members' emotional intelligence played a pivotal role in determining the success and functionality of the team, and the quality of final product being developed. It would appear that emotional intelligence skills underpin collaboration and communication skills needed for managing conflict and keeping the team focussed on developing the required product.

At a time when generic skills are being strongly promoted by employers and government funding authorities, it would be appropriate to further investigate this line of research in the affective domain. Further research in this area will be focussed on developing:
An evaluation instrument used to assess students' emotional intelligence at the beginning of the semester, to help advise students on how best to implement strategies to help with teamwork;
More focussed and probing interview questions needed to help uncover greater detail about underlying issues related students' emotional intelligence (lack and awareness of); and
More detailed procedures for tutors to use when running tutor led peer assessment sessions.

The results of this study show a compelling relationship between students' emotional intelligence and their ability to work effectively within a team. This has important implications for all discipline areas, where collaborative teamwork is incorporated as part of the learning environment. Visible skills and emotional intelligence should both be considered when selecting team members for a collaborative environment. Lecturers, tutors and students need to be made aware of emotional intelligence and the impact it can have on team success.

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ACADEMICS' CONCERNS ABOUT "THE PUSH FOR FLEXIBLE DELIVERY"

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Abstract

As part of a study of educational innovation in information and communication technology (ICT) disciplines, 83 academics from relevant departments across Australia participated in mini-conferences where they identified and discussed the factors driving and inhibiting educational initiatives. Participants repeatedly noted "the push for flexible delivery" as a factor driving educational innovation. This paper explores participants' views on this "push". Issues discussed include the direction in which academics perceive the "push" is pushing and academics' concerns about motivations behind the "push", changing work practices and implications for workload.

Keywords

flexible delivery, ICT education, academic work practices, academic workload

Introduction

The ICT-Ed Project

The Computing Education Research Group in the Faculty of Information Technology at Monash University is investigating the ways in which issues of teaching and learning have been approached within Information and Communications Technology (ICT) discipline areas in Australian universities. The project takes a three-pronged approach to issues of teaching and learning, with data collection phases that focus variously on the views of educators, employers and students. The first phase, focusing on the views of ICT educators, was completed in June 2001. This paper describes and discusses a sub-set of the many issues raised by ICT educators during this phase, in particular, those issues surrounding moves towards the flexible delivery of university subjects. As an introduction to the issues explored, an outline of the broader context of university education is given.

Higher Education in Australia

Over the last 15 years, Australia's universities, as with those in most countries, have been subject to extensive and multi-facetted change. These changes have resulted from a number of forces, including the advent of mass education (Coaldrake, 2000; Shattock, 2001) and, related to this, an increasing government focus on vocational education and the role of higher education in the national economy. These forces have manifest in a changing policy environment for the funding and governance of higher education (eg., Dawkins, 1989; Hoare, 1995; Vanstone, 1996; West, 1998), including an increasing need for institutions to compete for funding and for students and, therefore, to be more market-oriented.

Another element in the changing context of higher education is the advance and convergence of information and communication technologies and increasing globalisation (Cunningham, Tapsall, Ryan, Stedman, Bagdon & Flew, 1997). The convergence of ICT and subsequent increased accessibility, and uptake, of new electronic technologies has facilitated dramatic changes in the way many people work. Universities have embraced new electronic ICT as the source of solutions to many of the problems arising from the other rapid changes that have affected them.

In terms of teaching and learning, technology has been seen as a solution to the problems associated with increasing student numbers and the demand for increasingly flexible provision of education to an increasingly diverse student body (Coaldrake, 2000; Holt & Thompson, 1995). Information and communication technologies are also seen as a means of attracting and servicing new educational markets, both in Australia and internationally. Describing what they refer to as "the technological imperative", Holt and Thompson (1995) wrote:

> All tertiary institutions - whether they see themselves as being open and distance education institutions or not - are grappling with the challenge of information technology in relation to the very core of the academic enterprise: teaching and learning; research and scholarship. (p. 47)

These contextual factors help to explain, at least in part, many of the views expressed by the academics who participated in the study reported here.

Methodology

Mini-conference Program

The data reported here were collected using a *mini-conference* format. This format was devised to facilitate open discussion of issues perceived by participants to be relevant to ICT education. The mini-conferences ran from 10am to 4pm on designated days in each capital city. Two mini-conferences were held in Melbourne and in Sydney. One mini-conference was held in each of Hobart, Brisbane, Adelaide, Perth and Canberra. A video-link was used to conduct an abridged version of the mini-conference with educators in the Northern Territory. Numbers participating in each mini-conference ranged from four to fourteen. Small numbers allowed for discussion and for each participant to give a short presentation on a teaching and learning initiative currently being undertaken. Two researchers directed the proceedings.

Workbooks were provided to each participant on their arrival at a mini-conference. The workbooks provided a structure for the mini-conferences and provided participants with space to make notes in preparation for their contributions to discussions and presentation. They also served as a data source. The workbooks contained a description of the study, an informed consent form, space for participants to make notes and five stimuli items:

1. What are the factors driving educational initiatives in ICT education?
2. What are the factors inhibiting educational initiatives in ICT education?
3. Please describe a teaching and learning initiative in which you or your department are currently involved. (included sub-prompts)
4. Deciding whether your teaching initiative is effective. (included sub-prompts)
5. What issues would be involved in disseminating your initiative to other ICT educators?

Questions 1, 2 and 5 were used to stimulate discussion among participants. For each question, participants were given five minutes to think and make notes about the question before they were prompted to discuss the factors/issues involved. Discussions were 25 minutes long. As factors were raised and discussed, one of the researchers recorded them on a whiteboard; this involved some negotiation between participants. At times, the researchers asked for issues to be clarified or for examples to be given. All discussions were audio-taped and transcribed. The data presented here is taken primarily from audio transcriptions of discussions in response to questions 1 and 2. At times, participants returned to previously discussed topics, so some comments pertaining to factors driving and inhibiting educational initiatives were given as part of discussions of question 5.

Participants

To recruit ICT educators to the mini-conference program, invitations were sent to all heads of Australian university departments, schools and divisions where ICT-related courses are offered. These included departments of information systems, software engineering and computer science, for example. Department heads were encouraged to circulate invitations to their staff members. In total 83 ICT educators from 51 administrative units (46 departments/schools, 1 faculty, 4 university level education units) in 29 universities (27 public, 2 private) participated in the mini-conference program. Participants included staff members from a range of academic levels, including all levels of lecturer, department heads, professors, associate and faculty deans, one pro-vice chancellor and a small number of instructional designers.

Participants can be described as a group of ICT educators who are specifically interested in teaching and learning. The invitation to participate described the target group as staff members who are involved in teaching and learning initiatives that aim to improve ICT education. Participants self-selected into the study knowing that it focused on teaching and learning. The nature of participants' contributions indicated that they were not only interested in teaching and learning, but were enthusiastic about and committed to improving teaching and learning in their disciplines. When informally asked why they attended, participants generally gave reasons such as, "to find out what other people were doing." When asked what they had gained from participating, two benefits were frequently given: an opportunity to hear about what was going on in other institutions and an opportunity to reflect on and receive feedback about their own practice.

One qualification, or limitation, that should be acknowledged here is the failure in the reporting of data below to distinguish between the views of participants who have different roles in their departments. For example, no attempt has been made to distinguish between the views of mangers (eg. heads of schools) and those of lecturers. This is in part due to the type of data collected and the way it has been managed. Audio recordings were treated as focus group recordings: they were transcribed without identification of particular speakers. In this way, the position of speakers is difficult to determine. All participants were recruited in their capacity as ICT educators, rather than as representatives of their particular positions, and lecturers formed the majority of participants. It is evident from the content of discussions that they were skewed towards the concerns of teachers rather than those of managers.

Analysis of Data

A coding process was used to reduce the data collected. To begin with, a data-up, rather than theory-down, approach was taken to the analysis. For questions 1, 2 and 5, notes made in participants' workbooks and whiteboard records of discussions were coded into a large number of descriptive categories. These categories were then grouped, reducing the data further. They were then tested against transcriptions of audio-recordings of discussions, using the constant comparative method (Silverman, 2000; Strauss & Corbin, 1997). As data were compared categories were merged and revised. The resulting small number of categories allowed for the complexity of particular issues/factors to be captured in each category and examined. Particularly rich excerpts were coded into multiple categories. To increase the reliability of this coding process, a co-researcher inspected reports of each code for consistency.

The coding process, the resulting categories and the limitations to the study have been reported in more detail elsewhere (Collins & Lynch, in press; Lynch & Collins, in press).

Participants' Views

Phrases such as "the push for flexible delivery" were repeatedly noted in response to open-ended questions about factors driving and inhibiting innovation in ICT education. This phrase was used to label a major factor seen by participants as driving and inhibiting educational innovation. Other factors included individual initiative, the changing scale of teaching, the changing student population, the development of new content, the availability of new tools, support from management and student demand. These other factors have been described elsewhere (Lynch & Collins, in press). This paper is concerned only with those issues raised by participants that concerned "the push for flexible delivery".

An exploration of all references in the audio transcripts to flexible delivery revealed a web of interrelated concerns. At each mini-conference, participants expressed concerns about the motivation behind the "push" and about problems they saw resulting from the push, for example, those relating to work practices, workload, student access, equity and quality. Due to space constraints, only three areas of concern are described here: perceptions regarding the motivations behind the "push", staff work practices and staff workload. They are described below with reference to illustrative data excerpts and relevant literature.

A qualification should be made about the discussion that follows. *The push* is used throughout this paper as though there is a unified push towards particular types of teaching and learning practices. This is misleading because the pressures exerted on academics are not unified; they come from a range of sources. Participants worked in a 51 administrative units in 29 universities and, although many university administrators respond to the same pressures and policy environment, responses to this environment manifest in many different ways. However, as was seen at the mini-conferences, academics from different institutions can sensibly discuss "the push" and report common experiences and concerns.

Before describing the concerns discussed by mini-conference participants, we look at what participants meant by the term *flexible delivery*.

What was Meant by "Flexible Delivery"?

The push for flexibility refers to pressure to implement particular modes of teaching rather than the opportunities seen arising from the availability of new technologies. Participants were not asked to come up with an agreed meaning of the term *flexible delivery*. Discussions of terminology were rare in the mini-conferences. Instead, participants at each mini-conference identified "the push for flexible delivery" as a factor driving and/or inhibiting educational innovation. That such a push existed was not disputed within mini-conference discussions. Participants generally used terms such as *flexible delivery*, *flexible learning* and *online learning* in discussions of the push without distinguishing between them and, apparently, without needing to explain to their peers what the terms denoted. These terms were used interchangeably to refer to the use of Internet-based information and communication technologies in teaching.

Flexible delivery and similar terms were associated more strongly with the use of particular technologies, than with an aim to offer flexibility. In many discussions, *flexible delivery* was synonymous with web-based delivery. Participants repeatedly reported that they had been encouraged by management to "put it on the Web". Although a small number of participants described particular initiatives that focused on student-teacher and student-student interaction, general discussions about the push for flexible delivery suggested that participants experienced pressure for more information-focused initiatives, that is, pressure to create materials that could be used to transmit course content to students. In this way, the term *flexible delivery* was aligned with traditional distance education approaches, focusing on the production of materials to facilitate time/space independent learning.

The way participants used the term *flexible* does not reflect discussions in educational literature on open learning, student-centred teaching or constructivist learning environments (for example, see discussions in Lefoe, 1998; Oliver, 2000), nor does it reflect participants' ideas about best practice or their aspirations to be good teachers. Rather, it reflects the messages that participants have been receiving about the direction that their teaching should take, messages about the desires of their managers, and messages about the desired outcomes of government policy.

Participants' association of the push for flexible delivery with information-focused approaches to delivering course material may explain some of the concerns about this push that are described below and the general negativity towards the push that was expressed by participants. Taylor, Lopez and Quadrelli (1996) found that a key barrier to academics' involvement in the use of ICT to provide more flexible modes of delivery "lies in the assumed association of flexible modes of delivery with more traditional distance education practices" (p. xii). Similarly, Willmot and McLean (1994) found that teachers were wary of a "learning package" approach and advocated approaches that emphasised the importance and possibilities for human interaction. Many of the concerns described below can be better understood when seen in the context of the directions in which participants perceive "the push for flexible delivery" to be pushing.

Sources of the "Push"

The most commonly discussed source of the push for flexible delivery was top-down directives, that is, directives or expectations from government, university and/or departmental levels. Participants were often critical of, or even cynical about, these directives because they were suspicious of the motivations behind them. There was a general perception that educational motivations were not a primary consideration in the push. Very few participants discussed the push for flexible delivery in terms of educational value. Many discussions positioned the push as a government, university or departmental response to a problem or need. Problems or needs discussed included students' need for flexible (time/space independent) access and universities' need to find new markets and to cut costs. Typical comments about the needs or problems to which flexible delivery might be the solution are given in Table 1. These three areas of need are interrelated. Flexible delivery was seen by participants as being promoted as the means by which universities can satisfy students' needs, access new markets and cut costs.

Need or Problem	Data excerpt
Students' need for flexible access	I guess people who are working full time who want to study you know any time of day or night or people that are isolated or people who are at home with young children that anyone, people that have retired who feel as though they need, retired managers who think they need to know about computers, they must do a computer course via the Internet.
University/ department need for new markets	There is a tremendous influx in Australian universities. They've got more and more coming, of overseas students as on-shore students as well as to establish off-shore programs. That actually leads to certain necessities as to online teach, in terms of delivery, including distance education which actually becomes part of the whole initiative of you know, establishing an overseas off-shore forum basically.
University/ department need to cut costs	I was going to identify a similar thing at the school over lower funding in recent years; certainly at our school we've been encouraged to work smarter not harder. You've now got two subjects to teach per semester instead of one. Again it comes back to a financial pressure: we don't have the resources or the people or the academics to give students individual attention. So we have to use the technology because we just don't have the people power to do it.

Table 1: Needs or problems as a source of the push

Educators' criticisms of non-educational reasons for promoting flexible delivery have been reported by Willmot and McLean (1994) who noted,

> The thread that runs through teachers' discussion about flexible learning is suspicion that it is being promoted for non-educational reasons. Several teachers felt that flexible learning is an educational justification for an economic measure. … Teachers are anxious that management's priority of cost-effectiveness will mean that flexible learning is interpreted in ways that are not educationally desirable. (p. 102-103)

Participants' perceptions of the primacy of these non-educational motivations behind the push for flexible delivery do not bode well for the success of the push. Taylor, Lopez and Quadrelli (1996) recommended that, managers "advocate the value of technology in the service of educational ends"

(p. xiv-xv), arguing that "the issue of learning must become the central concern of academics and those who seek to influence their practices" (p. xiii).

Not only did participants see the motivations behind the push for flexible delivery to be primarily non-educational. They also believed that university administrators held narrow views about what constituted flexible delivery, as well as misconceptions about the costs and benefits of flexible delivery. The following excerpts are typical of comments about top-down expectations or directives for teaching staff to move towards the flexible delivery of subjects.

> At the high levels I think their beliefs are not necessarily founded on research about costs and about learning and about the quality of learning.
>
> You got to admit, I mean half the people in management they just, you know, every, "you can do anything on the Web now; we must have it on the Web."
>
> Participant one: Now separately but aligned with this question about not understanding what is possible this almost totally entrenched belief in some people that you can do absolutely anything on the World-Wide Web; if there's a problem all you have to do is put it on the Web and it will be solved.
> Participant two: Internet boosting
> Participant one: Yeah Internet hype.

Despite the large number of technology enthusiasts that participated in the mini-conferences, only a small number discussed flexible delivery in positive terms. When it was framed positively, participants were discussing the development of enabling technologies generally, rather than their specific application to flexible delivery, or they were discussing their own initiatives that made use of the potential of electronic ICT to enhance interaction, rather than the perceived push towards the electronic transmission of information. Participants' concerns about flexible delivery make sense when account is taken of their impressions of the types of activities that they saw as being promoted and supported, that is, information-focused, web-based delivery of course materials.

Work Practices and the Disintegration of Teaching

Participants described what they saw as an increasing trend towards the "disintegration" of teaching, that is, the de-integration of the production of subject materials and the delivery of subjects. Participants considered that there was more to teaching than the sum of its parts, expressing concern about the future of their roles as teachers. Linked to this concern were perceived threats to academic freedom and other issues related to a *packaging* approach to subjects. In the following data excerpt, one participant explains the trend in the production and dissemination of formal course materials and the motivations he sees behind this trend.

> So like if you think of the old-fashioned way that you have a set of notes which were yours and made sense to you, then we can't afford to have any more of that. So how does the head of school get that unit visible? Ask it to be put into PowerPoint or into Word, so that it's mounted on the Web, not under the guise of innovation and teaching, but so it's there, accessible for the next person. ... So there's got to be a lot of visibility there, a lot of extra things, because you don't know who's going to teach a particular unit.

Participants were generally uncomfortable with the idea of producing materials that others would deliver. One participant explained with some disbelief that, "At one point it looked like I was going to be lecturer-in-charge without teaching it at all". Conversely, similar discomfort was expressed at the idea of teaching with materials produced by someone else. Participants found it difficult to articulate why this was undesirable, with many referring broadly to teaching as a personal activity.

> Teaching is a very personalised activity and its highly individualistic ... I just think it's a very personalised activity – well it is at the moment; I take [another participant's] point about the de-layering or the disintegration of teaching that's occurring – but traditional teaching is in the

> sense that the academic both creates the curriculum, researches it, creates the learning materials and teaches it, and it's seen as an integrated whole. And it's only when, for example, you're given other peoples' lecture notes to try to teach from, I just can't do it. It is amazingly hard, you know, when occasionally you've been asked to teach a course and "it's all there", but you can't – you haven't worked your way through it. I really am not quite sure why, but I would find it impossible to teach that way. Having said that, increasingly it's a model that is being used in higher education, where people – private providers in the US are given material. Not only do they have to teach it, but they're not allowed to change it. They have to teach it as given. I could not teach that way.

Koppi, Chaloupka, Llewellyn, Cheney, Clark and Fenton-Kerr (1998) explained this phenomenon in terms of academic culture:

> Tertiary teachers are generally creative individuals and experts in a particular field. They are generally also critical thinkers and maintain an objective distance from the work of their peers. This combination inclines the teacher to design unique courses commensurate with personal experience and knowledge. In Australia in particular, this personal course development is accepted practice to the extent that cross-institutional formal evaluation and comparison of courses does not generally occur. An academic will not normally adopt another academic's course without personalising it. A key feature of academic culture is idiosyncrasy that is ardently defended under the rights of academic freedom. (p. 425).

Similarly, Taylor et al. (1996) found that,

> academics feel threatened and are reluctant to teach from packages because this requires that they teach other people's work – 'a very unrewarding teaching experience'. Reasons include: a perceived lack of skill to teach what somebody else has designed; differing viewpoints on course content; and loss of their authority as author. (p. 56).

As well as the reported difficulty in teaching from other people's materials, participants expressed concerns about the lack of control they anticipated having over their material once it had been subject to standardisation and packaging by the growing number of university level learning resource units. As one participant explained,

> Participant: I've got one more inhibiting factor: in terms of the university policy towards initiatives, in many cases there's a removal of control from the academics. Like at [my university] we have [a learning resources unit] which, from the university's perspective, are responsible for the flexible delivery, but what happens is that academics end up working for them rather, rather than them working for us, so that we're the providers.
> Moderator: You're the content provider?
> Participant: Yeah.
> Moderator: And they wrap it up?
> Participant: And they wrap it up and in many cases they wrap it up in a non-innovative way.
> Moderator: So how would you – ?
> Participant: Well I think I would just describe it as a removal of control if you like.

In his discussion of changes in academic work, Coaldrake (2000) explained that staffing policies are shifting from local control and individual autonomy to a more collective and institutional focus. This is inconsistent with the conventional ideals of academic work that extol academic freedom. Taylor et al. (1996) advised that, to support the move towards more flexible practices, institutions should "[assure] academics that they will continue to be able to exercise significant levels of personal control over their teaching practices" (p. 60).

Contrary to this recommendation, many participants reported trends towards the separation of the production of materials from their delivery. Participants were concerned that they would lose ownership over material and lose control over its delivery. They saw the delivery as integral to the aims they had for material. The reported trend towards the de-integration of teaching activities can be linked back to participants' perceptions that the push for flexible learning is focused on the provision of information.

Workload

Participants expressed concerns about their workloads that relate specifically to their impression of the type of flexible delivery that was expected of them, and the effects of an information-based approach to course delivery on their work practices. The approach implied by discussions of the push for flexible delivery is consistent with what Caladine referred to as an *industrial model* of education (cited in Taylor et al., 1996). This approach is described as having "high fixed costs involved in producing the teaching/learning resources" (Taylor et al., 1996). Participants were concerned that these costs would be absorbed into their already heavy workloads. They were particularly concerned because of the rapid development of content in their discipline areas and the resulting need to frequently up-date materials. The following data excerpts are typical of participants' comments on the work required to produce and update materials.

> When you try it you find that it adds to your workload. It doesn't replace the workload. … In the old days I might have my own notes and maybe some tutor notes and then we had student notes that we printed, and now we have our own notes, the supporting lecturer notes, student notes, student notes that are printed and they're also on the electronic form, and now we have a ripple for every time anything changes: you've got to change all those. Even if you say, "Now we're going to do this activity", you have to change, the content also changes, so you've got five or six things every time you change you have to change because you're doing all this extra supporting.
>
> There isn't really an electronic system that allows us to support our range of materials so that if we suddenly decide that we're going to teach something differently about a particular point, there's nothing that says, "ping, you have to change quiz three, question four", or "you have to change tutorial question 6, notes for this …".

Again, the extra work described by participants was consistent with a focus on the transmission of information. Constant up-dating of materials was seen as necessary if materials were to reflect the latest developments in subject areas and to meet students' demands to learn the latest programming languages and the latest software packages. University level learning resource units were not seen to be flexible enough to facilitate the frequency of up-dating required.

Conclusion

The discussions of the move towards flexible delivery recorded at the mini-conferences suggest that ICT educators are experiencing pressures to implement delivery modes that are modelled on traditional distance education approaches. This trend is seen as a response to non-educational aims and flies in the face of educational literature that recommends more open, student-centred approaches to learning and that focus on the potential of new electronic ICT to facilitate enhanced interactions between students and between students and teachers.

Participants in the mini-conferences expressed concerns about the direction in which "the push for flexible delivery" is pushing. In particular, they were concerned about the separation of tasks that they see as integral to teaching and to being a teacher. They were concerned about their future roles, changing work practices and increasing workloads.

However, these concerns and criticisms surrounding "the push" can be contrasted to the actual practices that participants reported being involved in. Many, in their criticism of the push, alluded to their own teaching and learning initiatives, which focused on interaction and student learning. As one participant put it, "the wrong reason with the right outcome". Despite pressures to move towards teaching practices that focus on the delivery of information and to implement very limited versions of *flexible delivery*, ICT educators are questioning and resisting this pressure, and are implementing teaching and learning initiatives that are motivated by educational aims.

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ARE THEY USING IT HOW WE THOUGHT THEY WOULD? AN EVALUATION OF STUDENTS' LEARNING PROCESSES

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Abstract

Despite the best intentions, educational technology developers often fail to carry out evaluations of their programs while they are under development. This paper reports on a formative evaluation of students' learning processes while completing an interactive multimedia program called Legal Interviewing Skills. The evaluation found that students used a number of learning strategies which were not predicted by the developers. The findings of the evaluation will be used to refine the existing program and in the development of subsequent modules.

Keywords
formative evaluation, students' learning processes, computer-facilitated learning, legal interviewing

Background to Torts Law and *Legal Interviewing Skills*

Students in the undergraduate law degree at Monash University complete a subject that deals with the law of torts. A 'tort' in law describes a breach of duty between parties who have no explicit contract. Students must become proficient in examining legal scenarios to determine whether an individual has a course of action which falls within the description of any of the torts covered in the subject.

In order to familiarise students with interviewing techniques associated with the practice of tort law, the lecturers introduced optional interviewing exercises for small groups of students using role-playing methods. With class sizes of 300-400 an investigation was conducted into finding an efficient and effective method for these interview exercises. To this end, a multimedia program, *Legal Interviewing Skills,* was developed. The product exposes common problems or pitfalls in legal interviews and helps students identify the skills needed to address these problems.

The Legal Interviewing Skills product consists of a suite of three CD-ROMs. The first CD-ROM covers material on general legal interviewing skills and is the focus of the evaluation reported here. The program is divided into four interrelated sections. There is an introductory tutorial detailing the basic skills required for conducting legal interviews. The second section of the program presents students with a nine-minute video that shows an interview between a lawyer and a client and exemplifies 'poor' interviewing techniques. The third section presents a similar interview situation, however, this time it exemplifies 'good' interviewing skills. The final section of the module is the 'interview evaluation' section in which students are asked to critically evaluate the poor interview and to critically reflect on poor interviewing techniques. The interviews are divided into a number of segments with each segment exemplifying a subset of communication and micro-skills highlighted in previous sections of the module. The student's task is to evaluate and identify aspects ('problems' or 'pitfalls') of the interview that have been poorly conducted by the lawyer. For each segment, students are asked to identify (by checking a box) all 'problem' skills in evidence before moving on to the next segment. After indicating which skills they feel are problematic in the segment, students can obtain feedback as to whether their selections are correct or incorrect as deemed by an expert. For further information, students can hyperlink to an explanation of each of the micro-skills that have been identified. Accessing this information is optional and students may choose to skip this activity and progress to the next video segment. The task is cumulative in that students are exposed to a greater variety of skills as they progress through the evaluation exercise.

Evaluation Focus

Our overarching goal of this evaluation was to see whether the program was used in the way it was designed to be used. Reeves (1993) comments that multimedia developers may agree that a particular feature of a program is worthwhile only to find that the same feature is seen by the learner as irrelevant, distracting or confusing. Often due to limited resources (time, personnel or financial) scant attention is paid to the way users interact with program during its development (Reeves & Lent, 1984). This results in an implicit assumption on behalf of developers that their program's design is transparent and that learners will use it in the way the developers intended.

The focus of this evaluation was guided by the evaluation framework developed by Alexander and Hedberg (1994) and extended by Bain (1999). This framework has four primary phases (analysis and design, development, implementation and institutionalism) and its core features are similar to other evaluation frameworks (see Draper, Brown, Henderson & McAteer, 1996; Reeves, 1989, 1993). This evaluation falls in the development phase of Bain's framework and as such is formative in nature, focussing on refining and improving the program. In the development phase Bain (1999) highlights the need to investigate both the learning environment and students' learning processes. Thus, this evaluation sought to determine whether the computer facilitated learning environment was functional and accessible to students. In addition we were interested in how students used the program and their learning strategies as they navigated their way through the package.

Method

Twenty-three students undertaking the Postgraduate Diploma in Legal Practice, Skills and Ethics at Monash University in the latter half of 2000, participated in the evaluation. While the program was developed with students in the early years of an undergraduate law degree in mind, the lecturer in charge of the postgraduate program thought that it would be a useful addition to the postgraduate diploma and the sample was thought to be appropriate for this reason. Ten males (43%) and thirteen (57%) females participated in the evaluation and their ages ranged from twenty-three to sixty-one, with the average age being 35.52. Of the sample, almost half (43%) had had previous interviewing experience and two (9%) had experience as a lawyer.

The class was divided into two groups for the evaluation with students working individually with the program over a one-hour period in a computer lab. In order to collect data on students' learning processes, predominantly qualitative data collection techniques were used including observation, think-aloud and think-write protocols, and a focus group. Four trained observers carried out real-time observation of eight students completing the program. In each group, two students used tape recorders to construct an oral account of their progression through the program (think-aloud) and all students were encouraged to write down their thoughts of the program as they were working with it (think-write). Seven students from the first evaluation group were asked to participate in an informal, but semi-structured focus group at the conclusion of the session. The first author led the focus group in which three other researchers participated. All students completed a questionnaire containing both quantitative and qualitative items at the conclusion of the class.

Results

The results reported in this paper are part of a larger evaluation of *Legal Interviewing Skills*. Only results associated with the focus of this paper, namely, students' learning processes, are reported here. As qualitative data was collected using different techniques, students' comments are provided in italics and the source of the data is provided in parentheses. Most of students' responses regarding their use of the program related to the way they negotiated the final 'interview evaluation' section, and as such, this is the primary focus of the results.

Many students found the interview evaluation task frustrating and tedious, especially when they could not easily identify all the interviewing problems for a particular video segment. Students were particularly frustrated when they felt they could not progress to the next segment of the interview until they had correctly identified all the relevant micro-skills. The program did not restrict students' progression through the interview; rather students often restricted their own progress by refusing to move on until they had identified all the interviewing pitfalls for each segment. Typical comments included...

- *Sometimes answering the evaluation questions became a bit tedious.* [questionnaire]
- *[On] some occasions as far as I was concerned there were four really obvious questions [problems] and two which could have been any out of the ten. And then that got really frustrating for me because .... it could be [any of] these six and you're there just messing about trying to get the right two.* [focus group]
- *It was very frustrating for me not getting the right answers over and over again, but I kept going until I succeeded, I am pedantic.* [think-write]
- *I must get an answer, I cannot proceed until I do....* [think-write]

Possibly as a result of this frustration, a number of students indicated that the interview evaluation task soon became one of 'getting the right answer' rather than reflecting on the use of appropriate and inappropriate interview techniques. A number of students in the focus group and those participating in the think-aloud protocol suggested their completion of the evaluation section became more an exercise in 'trial-and-error' or 'systematic guessing' to get the right answer rather than reflecting on how particular problems manifest themselves in interviews. As a result, the goal of the learning task became the identification of the full compliment of problem skills for each interview segment rather than reflecting on how these skills affect the interview process. Typical comments included...

- *[I] spent more time trying to get the little red tick rather than actually thinking about the content.* [think-write]
- *There was no sense of you actively thinking about what you'd done wrong, it was more trying to get the right answers.* [focus group]

Despite these reactions, 65% of students agreed that the program generally encouraged them to reflect on the content area and only three students (13%) thought this was not the case. There seems, therefore, to be some disparity in these results. More research is needed to determine which aspects of the program encourage reflection and the degree of congruence between students' learning activities while using the program and their use of self-regulatory and reflective learning strategies.

Comments suggested that students' learning process of 'systematic guessing' may be linked to the failure of the program (and its developers) to provide adequate feedback. That is, if more meaningful feedback were provided to students detailing *why* a particular answer was wrong, they may be encouraged to make a more considered second attempt at the problem rather than adopting a 'hit or miss' approach to simply obtain the 'right' answer. Although half the respondents thought the feedback was meaningful, a third (32%) indicated that they felt the feedback was not meaningful to them and 44% suggested the feedback did not help them understand where they went wrong.

While it was interesting to see that students used a number of strategies to complete the 'interview evaluation', one strategy which students didn't use came as a surprise to the developers. Students had the ability to hyperlink from any of the micro-skills within the evaluation exercise to detailed information about that particular skill. This function was used sparingly by students. The developers assumed that students would use the hyperlink function to re-visit the summaries of general interviewing skills to assist them with their analysis of the interview segment. However most students attempted the evaluation exercise without needing this information and seemed to rely on their prior knowledge, knowledge they had previously acquired from the resource, or by toggling between the good and poor interview videos. When questioned in the focus group, many students said the reason why they did not use this function was they did not know it was available. Clearly this has implications for the instructional and interface design of this section of the program.

- *I didn't even try that [hyperlink] because all the other things earlier that I thought [were hyperlinks] weren't, so I didn't even bother.* [focus group]

Conclusion

The evaluation of students learning processes focussed mainly on the "interview evaluation" section of the *Legal Interviewing Skills* program. We discovered that students found this section somewhat tedious and, in some instances, not particularly challenging. The developers underestimated how persistent students would be in this section. That is, students refused to move on to the next video segment until they had satisfactorily completed the section they were in; which meant finding all the correct answers. This desire for success led many students into a learning strategy of "systematic guessing". We hope this problem can be alleviated by providing more adequate feedback to students (an aspect of the program students were critical of) in order to encourage greater reflection and more meaningful interaction with the evaluation section. It may be possible to achieve a similar outcome by restructuring the task itself so that students are given a limited number of chances to select the correct answer.

The development team will use the findings of this evaluation, not only to refine and improve the first module in the *Legal Interviewing Skills* suite, but also to inform the development of the remaining two modules. The formative evaluation of students' learning processes has been invaluable in contributing to the developers understanding of how students interact with their program. Due to its timely nature information gleaned from the evaluation can be easily fed back into the design and development cycle.

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COMPUTER MEDIATED COMMUNICATION WITH INTEGRATED GRAPHICAL TOOLS USED FOR HEALTH CARE DECISION-MAKING

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Abstract

This paper discusses the development of a set of graphical tools for health care decision-making integrated in a threaded discussion forum. The capability to draw a graphical representation of a health care situation enables decision-makers to conceptualise their decision-making visually. The integration of these tools in a threaded discussion environment allows collaboration with others in developing a common understanding and provides a permanent textual and visual record of the process of decision-making. This development of the text based CMC environment to include graphical tools has potential application across a wide range of disciplines.

Keywords

graphical and visual tools, computer mediated communication (CMC), interactive and collaborative technologies, health care decision-making

Introduction

Computer Mediated Communication (CMC) has become a fundamental tool of the online teaching and learning environment (Harasim, 1989; Hara, Bonk & Angeli, 1998). Although the human mind grasps and processes complex facts more efficiently when they are presented visually (Weiskrantz, 1988), the emphasis of CMC has been on the use of text-based asynchronous threaded discussion forums, with only limited use of graphics (Spoon & Guzdial, 1999). Purely text-based CMC may limit our ability to express our thoughts (Kuehn, 1994 in Hara et al., 1998). The use of graphical tools within a CMC environment offers the potential to provide a new channel of communication that may enhance our ability to collaboratively construct and agree on meaning (Van Boxtel & Veerman, 2001).

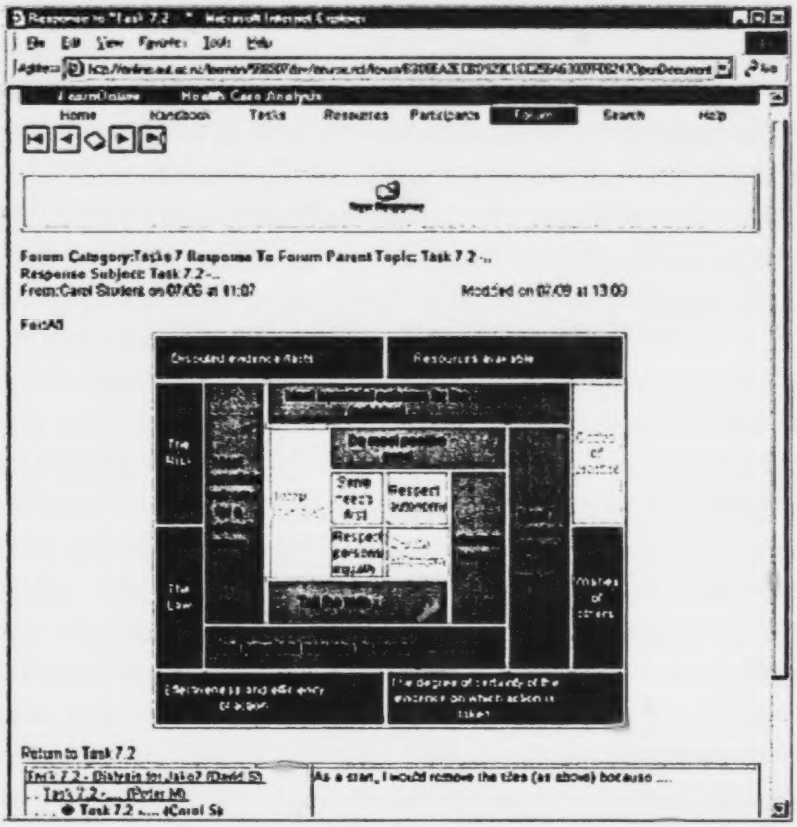
Over the last fifteen years David Seedhouse has developed and documented a range of visual decision-making tools for health professionals (Seedhouse, 1998, 2001). Their use has previously required either some physical means of representing the tool or required continual manual (and therefore time-consuming) redrawing of a graphic image.

This project involved the development of computer-based versions of Seedhouse's healthcare analysis tools in a format that would allow the graphical images to be manipulated and recorded within the context of a threaded asynchronous discussion forum.

Four tools (the Ethical Grid, Rings of Uncertainty, Foundations of Health and Autonomy Test) have been developed for use in an online environment using a standard web browser; the first two are described here. The tools were constructed within *LearnOnline*, a Lotus Notes based online virtual learning environment developed at the Auckland University of Technology. The graphical tools use specialised subforms that are incorporated within standard topic/response forms in a threaded discussion forum. Responses inherit the graphic state of the posting to which the response is made (unless reset), so that the progressive development of the graphic and text based collaboration is explicitly recorded.

The Ethical Grid

The ethical grid consists of a set of 20 tiles, arranged in 4 concentric rectangular rings of different colour. Each tile makes a simple statement open to interpretation, within a category represented by a different colour. The outer (black) ring represents practical considerations, the next consequences and priorities (green), then duties (red) and finally the inner four tiles represent health care purpose (blue).


Response to "Task 7.2 ..." - Microsoft Internet Explorer
File
Edit
View
Favorites
Tools
Help
Address
Go
LearnOnline
Health Care Analysis
Home
Handbook
Tasks
Resources
Participants
Forum
Search
Help
Discounted evidence (facts)
Resources available
The Risk
The Law
Codes of practice
Wishes of others
Serve needs first
Respect autonomy
Respect persons equally
Effectiveness and efficiency of action
The degree of certainty of the evidence on which action is taken

Forum Category:Tasks 7 Response To Forum Parent Topic: Task 7.2 -..
Response Subject: Task 7.2 -..
From:Carol Student on 07/06 at 11:07 Modified on 07/09 at 13:09

Return to Task 7.2

Task 7.2 - Dialysis for Jake? (David S)
.. Task 7.2 - ... (Peter M)
... ● Task 7.2 - ... (Carol St

As a start, I would remove the tiles (as above) because ....

Figure 1: A saved 'Ethical Grid Response', showing the grid diagram (with 3 tiles removed), thread and text comments

As initially developed this tool used Lotus Notes server-based functionality to deliver a simple HTML form to the browser, and to process the responses. Once saved, a response shows the grid, the navigation thread and comments (Figure 1).

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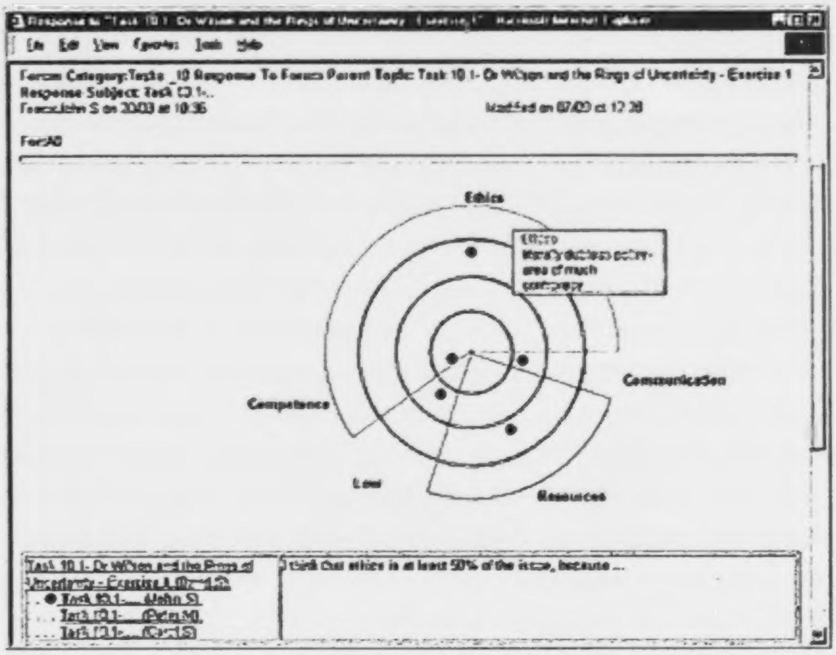
One use of the tool involves a group examining a specific health issue or hypothesis by progressively removing (or adding) tiles until the fundamental aspects of the issue are represented by a few key tiles. The process of thinking and negotiating involved in reaching this final state is often more important than the final state reached, particularly when used for educational purposes.

Rings of Uncertainty

The Rings of Uncertainty is another graphical model which allows users to reflect upon possible roles and interventions and to collaborate to reach a common understanding. The concentric rings represent varying degrees of uncertainty, with uncertainty increasing with distance from the centre. The rings are also divided into sectors, in this version representing ethics, communication, resources, law and technical competence (see Figure 2).



I think that ethics is at least 50% of the issue, because ...

Figure 2: A saved 'Rings of Uncertainty' Response, showing the diagram, comments and thread, and 'roll-over' documentation for 3rd Ethics ring

The demands of representing a series of manipulations of The Rings of Uncertainty meant that it had not been possible to develop a simple concrete tool, and the time required to redraw each iteration had limited its practical application.

The online tool uses a combination of Lotus Notes server based functionality and client browser dynamic HTML, again using specialised subforms within the Forum. This allows the position within any sector (represented by the dots) to be varied (by clicking at the required position). The angle allocated to each sector can also be varied according to the importance placed on that factor (by entering percentages). In-built documentation is provided in the form of a 'pop-up' description as the mouse rolls over the relevant ring/section.

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Conclusions

At the time of writing only limited trials have been carried out with these tools in learning situations and they have been mainly used for demonstration purposes. We hope to research the use of these tools in a teaching environment in 2002. Health practitioners are also using these tools in developing and formalising workplace practices.

The incorporation of graphic tools within a threaded discussion forum adds an extra dimension to the capability of Computer Mediated Communication. The ability to store a record of the process of decision-making provides essential documentation to justify decisions and also offers opportunities for research into the effectiveness of such processes.

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DESIGN INFLUENCES IN THE CREATION OF AN ONLINE MATHEMATICS UNIT FOR INDIGENOUS ADULTS

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Abstract

This paper documents the specific influences on the design decisions associated with the creation of an online unit for Indigenous adult learners. As part of a bridging course, the unit of study, Thinking Mathematically, primarily aims to increase the students' mathematical skills and confidence levels in a supportive, constructive context. The manner in which the unit was designed was informed by a number of important factors relating to the specific student audience, the mathematical content of the unit, online learning principles and past feedback from our students. The presentation of the unit content, the provision of learning tools and the selection of communication technologies are aspects of the unit that are examined in this paper.

Keywords

Indigenous, pre-tertiary, online, mathematics, education, instructional design

Background

Thinking Mathematically is one unit within a one year university bridging course for Indigenous adult students in Kurongkurl Katitjin, the School of Indigenous Australian Studies, at Edith Cowan University in Perth. The course, Indigenous University Orientation Course (IUOC), is made up of a total of six units which students usually complete in a one to two year period. The Thinking Mathematically unit has recently been designed and delivered to students in a print-based external mode of delivery. During 2001, a team of online unit development staff worked with an academic staff member, the content expert, to create the online version of this unit. The unit aims to provide basic numeracy life skills for Indigenous adults. These are presented in the context of an Indigenous family and some of the everyday mathematics situations they may encounter.

Previous research conducted within the School has provided a strong influence in the planning and development processes adopted to develop the online version of this unit. The overall direction of the school's adoption of online unit development and delivery is clear from the School's policy documentation (Stratton, 2000). Observation and testing of students using the online unit material provided specific assistance in the selection of successful online strategies (Northcote, 2001). Also, from extensive interviews with students working in Regional Centres, there was a clear indication that they equated mathematics with budgets and money (Marshall, McLoughlin & Hayward, 2000). However, there were some students who could make a connection between the mathematics they had experienced in their education and any real-life situation. Students were also asked about their perceptions of online learning in general and mathematics in particular. The majority of the students indicated a preference for learning online, although there was some concern at inputting mathematical symbols via the keyboard. They believed that a certain amount of print-based activity would be needed. In general, the students said that they would prefer to study in an online mode. They also commented that tutorial support would be essential (Marshall et al., 2000).

Additionally, our recent evaluation of other online units within the IUOC course has directed our design efforts in relation to which ideas were successful and which ideas to modify or refrain from using. The content expert's knowledge of the unit content combined with her vast experience of teaching mathematics to adults also impacted heavily on the design of this unit. Lastly, the results of a survey of recent literature on the topic of online learning and current instructional design practices have guided our decisions about how this unit was designed and developed.

Theoretical Framework and Influences

The overarching theoretical principles of situated learning ultimately led the instructional design processes adopted to create this course. The curriculum design team were guided by the aim of creating authentic conditions into which supporting media and real life examples were set (Herrington & Oliver, 1997; Wilson, 1995; McLellan, 1994; Brown, Collins & Duguid, 1989). As a direct consequence of the research conducted in 1999 at the School, it was apparent that many students had negative attitudes about mathematics but were quite positive about learning in an online environment. These findings were applied in the way the interface for the unit was designed. By acknowledging our target audience's attitudinal base, we could respond to their immediate needs by creating an interface that was non-threatening but motivating at the same time (Evans & Edwards, 1999; Stoney & Wild, 1998). The role of emotion in the process of learning was absolutely critical to the predicted student success rates in this unit. As such, we aimed to create a supportive environment that recognised the interdependent roles of negative and positive emotions in the learning process (Pintrich, Marx & Boyle, 1993; Ames & Ames, 1991).

Although the design team were very much driven by the results of previous evaluation and research projects which were based on the students within the school, the overall importance of designing a unit which was tailored to the needs of Indigenous students was not overlooked. Considering the cultural contextuality of the learners, the development team attempted to create an environment that considered the theoretical understanding of Indigenous ways of learning. Harris' (1984) research within a remote Aboriginal community in the Northern Territory, highlighted five learning styles of these children. It is important to note that this theory is grounded in Indigenous children's learning styles not that of adults and that reflective research and discussion by others have questioned the theory of particular Aboriginal learning styles. Nevertheless, there is a strong suggestion that Indigenous learning styles differ enough to warrant attention by educators (Andrews & Hughes, 1988). Hughes and More (1997) provide an overview of each of the Aboriginal learning styles or ways of learning as such:

- Learning through observation and imitation rather than verbal instruction
- Learning through trial and feedback
- The group is more important than the individual
- Holistic (global) learning
- Visual-spatial skills
- Imagery
- Contextual learning
- Spontaneous learning.

To some degree each of these learning features have been explored as part of the unit and implemented into the instructional design of the learning environment.

Design Features

After a consideration of the theoretical framework and subsequent design features mentioned above, the manner in which these ideas were applied to the practical design of this unit will now be outlined. There were obviously some major factors that affected the instructional design of this unit and these provided us with definite course features that were integrated throughout the course. These are outlined in Table 1.

Influencing factors	Design features
Students' perceptions of mathematics	Countered negative experiences of mathematics with positive ones. Supportive "look" and "feel" – use of cool colours, simple navigation.
Students' attitudes to online and print based learning	Students preferred online options but wanted some form of paper-based material.
Research into Aboriginal ways of learning	Holistic learning environment with family as focus; providing a non-judgemental learning context using money, budget, work skills etc.
Literature about online learning principles	Use of cognitive tools (glossary, calculator, workbook and calendar). Combination of linear and non-linear design. Acknowledgement of prior knowledge – option of "have a go" section at the beginning of each module.
Mathematical content and process	Provision of paper-based components for students to record their work.
Real-life context	Situated Learning environment.
Learning context (Student needs, interactivity, available resources and access)	Choice of website creation instead of stand-alone CD-ROM. Provision of customised graphics, video, voiceovers, interactions, animation etc.
Literature on the value of hyperlinking for conceptual and administrative purposes	Selected links within unit material.

Table 1: Influencing factors and design features

Implications for the Future

As a result of this unit development process, we have gleaned some valuable knowledge to use for future course design. It is anticipated that this particular unit will be delivered to external students in Semester 1, 2002. However, trialing the unit with students is expected to take place in Semester 2 of 2001. Our baseline research will also occur at this time in the form of an online survey form which students will encounter when they first enter the online unit. We have learned of the value of baseline research as an indicator of the general and specific needs of our students. For this reason, we will continue to collect feedback from students and course evaluators before, during and after the development of the units takes place. Evaluation of online and multimedia course material will continue by adapting Reeves' (1997) dimensions.

In an online environment a reflective means of self-evaluation and adapting the medium is more possible due to the nature of the technology. However it is essential that designers do not apply a standard template or method but continue to design media in response to the learners' needs and the context in which the content is delivered. This is true of all learners, both Indigenous and non-Indigenous.

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TEACHING SOILS ONLINE USING A PROBLEM-BASED LEARNING DESIGN

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Abstract

Problem-based learning (PBL) was used as the instructional design basis for a TAFE unit of competency developed for online delivery. The courseware was commissioned to provide online content for users of the Victorian TAFE Virtual Campus. The aim of the project was to provide courseware that would develop competency in the course topic 'Soil Characteristics and Survey Techniques' and also develop generic skills in communication and collaboration. This article provides a theoretical basis for the application of PBL to instructional design, and a case study of the development and a trial application of the project.

Keywords

cognition, constructivism, problem-based learning, authentic assessment, multimedia, online learning, instructional design, evaluation, generic skills

Introduction

One of the most important reasons for using online technologies in education is to support flexible modes of learning that suit the diversity of learner needs and enable learners to develop a wide range of skills. These skills include technological literacy and the capacity for self-directed learning, as prerequisites for lifelong learning in a rapidly changing society. Development of these skills is an important part of the rationale for the Victorian TAFE Virtual Campus (TAFEVC). To foster the development of these skills, teachers using the TAFEVC are encouraged to develop courseware that 'provides active, meaningful learning experiences for individuals and opportunities to communicate and collaborate with others' and to 'ensure that online programs form a holistic option for learning by implementing techniques for validation of assessment processes and practical exercises' (PETE, 2001, p. 11). To support this development, TAFE in Victoria have sponsored the development of online content in a wide variety of subject areas. The online content materials can be used by teachers to support student learning of complete units of competency, for on-campus or external students. They are freely available to all Victorian TAFE providers using the TAFEVC.

This paper considers the design and development of an online unit of competency in Horticulture, covering soil sampling and survey techniques. A problem-based learning (PBL) approach was used as this particular approach to teaching and learning has been developed to build generic skill capacity through active learning methods that ask the student to deal with real problems from practice (Candy, Crebert & O'Leary, 1994). The case study focuses on the design and development of the course using the PBL approach, with evaluation data from a small student group who were the first to use the unit. The students used the unit in an external study mode.

Needs for Online Courseware

The introduction of online learning materials is seen to have significant long-term implications. In a forward planning document for the introduction of the TAFEVC, the State Training Board of Victoria (STBV) identified three key outcomes that should be achieved through effective development and use. These are:

- improved learning outcomes through creative applications of technology in teaching/learning transactions;
- greater access to and participation in training through more flexible approaches to mainstream delivery; and
- familiarisation with and practice in the applications of information technology required in vocational settings.

Online technologies are seen to have the potential to create new approaches to teaching and learning, while 'also enhancing traditional delivery models' (STBV, 1998, p. 3). An important part of the rationale for the application of online technologies is the deregulation of the marketplace for training, leading to a national and international market for training courses.

In a later document the same goals were outlined, and additional goals relating to a capacity for self-directed learning leading to the ability for lifelong learning were stressed. To achieve this, enabling strategies were recommended, including strategies that would:

- encourage the development of courseware that provides active, meaningful learning experiences for individuals and opportunities to communicate and collaborate with others; and
- ensure that online programs form a holistic option for learning by implementing techniques for validation of assessment processes and practical exercises (PETE, 2001, p. 11).

The attainment of these goals requires new approaches to providing learning materials using online technologies.

Rationale and Characteristics of Problem-based Learning

PBL was selected as the preferred basis for the instructional design of the project materials as it is an approach to learning that is designed to develop learning for capability rather than for the sake of acquiring knowledge (Engel, 1997). The PBL approach is based on constructivist principles in which the emphasis is placed on the learner's actions in reaching an understanding of the topic. As the learner must actively try to solve the problem, no passive learning for an essentially reproductive task is viable for the learner. Some important attributes of the constructivist approach as it relates to PBL are:

- understanding is developed through our interactions with the environment;
- the stimulus for learning is a cognitive conflict or problem, and this determines the organisation and nature of what is learned; and
- knowledge evolves through social negotiation and through evaluation of the viability of individual understandings (Savery & Duffy, 1994).

These attributes are applied in a PBL framework as the learner is first presented with the problem that needs to be solved. This is followed by a guided learning process in which the learner, either alone or in a collaborative process with other students and the tutor, clarifies the problem and acts to acquire the necessary knowledge and skill to reach a satisfactory resolution (de Grave, Boshuizen & Schmidt, 1996). The learning process is motivated by the learning task, and the environment for the problem becomes the environment that the learner interacts with in problem-solving. This provides a challenging environment in which the students learn to use information in meaningful ways (Margetson, 1997).

A desirable attribute of problems used in PBL is that they should be 'ill-structured' (Koschmann, Kelson, Feltovich & Barrows, 1996). Many academic tasks require well-structured problem-solving, in which the student works towards a convergent or single known solution. Many of the situations that students will experience when they graduate however, are complex and are open to several different solutions. Dealing with problems of this nature may require different skills from problems that have a single solution (Jonassen, 1997). Problems are ill-structured or ill-defined if the problem statement does not readily specify the solution so that the learner must learn to identify the real nature of the problem, any information that is necessary but missing from the problem statement, and a process for arriving at a solution (Jonassen, 1997).

The principal reason for using a PBL approach is to develop generic skills that are of value across the curriculum and, more importantly, in the students' professional environments following graduation, or during the course of study for part time students. Some of the generic skills that are developed in the PBL approach are:

- adaptability to change;
- dealing with complex problems and making reasoned decisions in unfamiliar situations;
- reasoning critically and creatively;
- adopting a holistic approach to problem situations;
- practicing empathy and appreciating the other person's point of view;
- collaborating productively in groups or teams; and
- identifying your own strengths and weaknesses, and achieving some remediation for weaknesses through self-directed learning (Engel, 1997)

An important part of the skill of the instructor who is using a PBL approach is to select problems that will enable and encourage the students to develop the above skills in the learning environment that is created. Learning tasks need to be authentic by representing or being based on real problems that the students may have to confront. The student is placed in the situation of being or playing the role of a stakeholder in the problem situation, such as being a consultant who is requested to find a solution or course of action for dealing with the problem (Sage & Torp, 1997). Assessment must be based on the skills required in problem-solving by assessing the performance of the skills in a realistic situation (Reeves & Okey, 1996). The application of assessment to the resolution of the problem tasks forms a basis for what Biggs (1999) describes as 'alignment'. He considers that PBL is a perfect example of alignment as the: "objectives are to get the students to solve problems they will meet in their professional careers—the teaching method is to present them with problems to solve; the assessment is based on how well they solve them." (Biggs, 1999, p. 71).

PBL is a powerful approach to teaching and learning as it focuses student learning towards the type of situation they will be working in as a graduate, and builds confidence in being able to function in these roles. By using this approach to design instructional multimedia materials, the power of PBL can be applied, and enhanced, using instructional technologies.

Case Study – A Course in Soil Sampling and Survey Techniques

The Institute of land and Food Resources at the University of Melbourne received funding to develop an online course for the unit of competency taken from the Horticulture Training Package - RUH HRT 358A Survey Soil Characteristics. The competency-based nature of the topic is suited to a PBL approach. The first two columns in Table 1 are an extract from the Horticulture Training Package and detail the industry competency specifications and performance criteria. These specifications were the starting point for the course design. When using PBL one of the most critical issues is the selection and specification of the problems. These need to represent real-world applications that require all of the necessary knowledge and skill to resolve (Stinson & Milter, 1996). A series of problems on soil sampling and soil analysis that matched the required competencies and performance criteria were needed.

Element of Competency	Performance Criteria	Instructional approach
358.1 Determine soil characteristics by performing a soil survey		The problem scenario is based on a couple who plan to set up a commercial flower growing enterprise. We are introduced to them and they explain what they aim to achieve, the type of plants they wish to grow, and how they need to prepare their land. They begin with the process of sampling the soil to determine its suitability for a range of plants.
	358.1.1 The density and depth for a representative sampling of the area are determined in consultation with the supervisor.	By using the resource material, students need to locate all information on the proposed growing site necessary to complete the paddock information form.
	358.1.2 Holes are excavated as determined at sampling sites according to enterprise policy.	The student is asked to identify where on the property the sampling should take place, and the sample depth etc. given photographs and a sketch map of the property. The student is advised of the resources that are available to help with the task. These include: • A virtual version of the sample bag used to send the samples to the lab; • Sampling instructions from the laboratory; • An expert who can be 'asked' for advice (photos, audio) from the lab; and • An online tutorial on sampling techniques.
	358.1.3 Soil samples are collected for off-site assessment using recommended procedures.	Students are to complete a paddock information form and the label for the couple, and submit this for assessment. Students demonstrate actual sampling to a teacher or workplace supervisor.

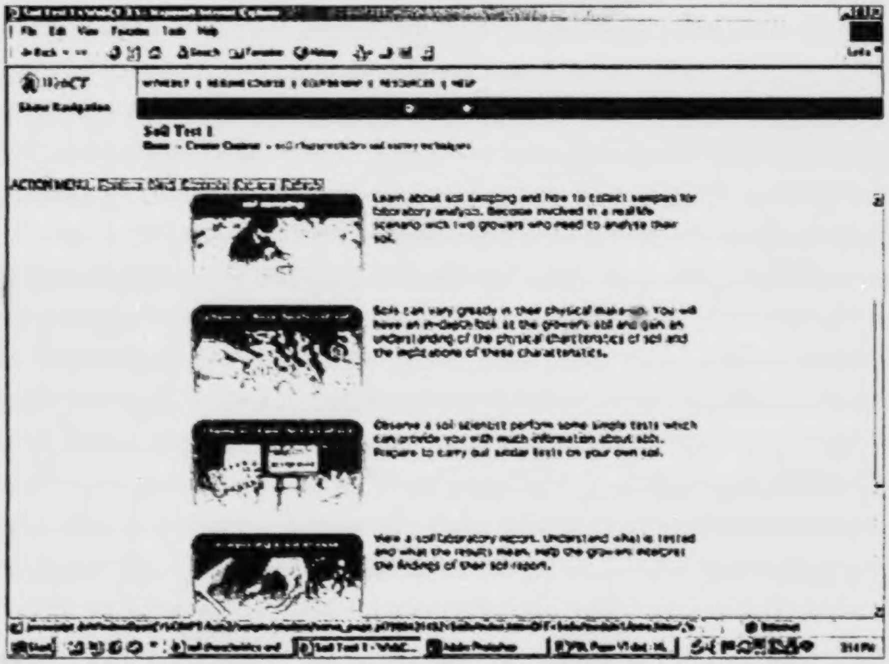
Table 1: A sample of the competency statement (Columns 1 and 2) and the teaching/learning strategy

The initial design issue was to select the range of problems. These needed to be real tasks that would require the students to learn and apply the skills specified in the competency statement. It was also important for the problem tasks to be the assessable tasks. The aim was to ensure a motivational context for the students by making the problem tasks realistic and assessable, and to structure the problems to bring the objectives, instructional methods and assessment into alignment in accordance with Biggs' (1999) recommendations. The problems selected were based on:

a) a real scenario of two growers in the process of establishing an flower-growing operation; and
b) the students' own properties or workplaces.

The problem tasks are either to propose a solution to a specific issue for the two growers, or for the students to use the growers' situation as a trigger but to carry out the task on their own property or workplace.

The analytical process is illustrated in Table 1. Five problem tasks were selected to cover the entire course. Column 3 shows the description of the first problem task, to illustrate how attainment of the performance criteria would be embedded in the problem-based instruction. The complete analytical document detailed the same process for the entire course, covering two elements of competency and all associated performance criteria.



Soil Test 1

Learn about soil sampling and how to collect samples for laboratory analysis. Become involved in a real life scenario with two growers who need to analyse their soil.

Soils can vary greatly in their physical make-up. You will have an in-depth look at the grower's soil and gain an understanding of the physical characteristics of soil and the implications of these characteristics.

Observe a soil scientist perform some simple tests which can provide you with much information about soils. Prepare to carry out similar tests on your own soil.

View a soil laboratory report. Understand what is tested and what the results mean. Help the growers interpret the findings of their soil report.

Figure 1: Main Menu showing the range of problems

A reference group was an important part of the analysis and design process. This group consisted of a range of representatives from local industry, government organisations and other colleges. This group was invited to consider the project at several stages of development beginning, critically, with the initial analysis document illustrated in Table 1. Many suggestions came from this group that made the design more accessible (such as including a text version as an optional alternative to audiovisual presentations), and helped to clarify issues relating to the interpretation of the performance criteria. This group was involved at milestone stages in the development of the project.

The course materials are structured to include all course content in the resource materials associated with one of the five problems. The menu structure for these is illustrated in Figure 1. (One additional scenario is not visible in the screen shot). Each problem is presented as realistically as possible using an audiovisual presentation of the scenario in many cases (see Figure 2). Grouped with each problem are the resources the student may use to carry out the learning task. These consist of illustrated content material and links to other websites such as Victorian Resources Online.

Students are provided with content materials in the form of a resource collection that enables them to explore the content. The menu structure facilitates exploration by providing a standard navigation link back to the resource page so that students can move rapidly from one resource area to another. The problem-based structure encourages the students to be searching for meaningful solutions as they are immersed in the task while they are using the resource collection. The content materials are presented in some depth as the students need a comprehensive knowledge of the subject area.

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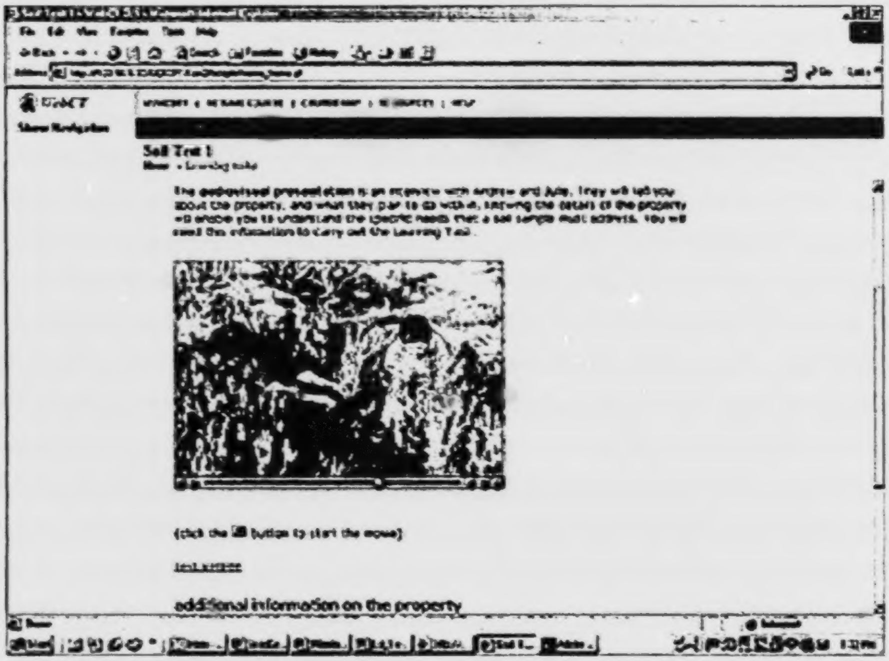

(click the button to start the movie)

additional information on the property

Figure 2: Audiovisual presentation of a problem scenario

Within the course there is a high level of emphasis on practical applications. Students carry out tasks such as making a physical and chemical analysis of the soil on their own property or workplace. To ensure that the practical competence is attained, a sign-off sheet listing a range of practical tasks, can be downloaded from the courseware. These need to be demonstrated to a teacher or workplace supervisor. In this way, students working at a distance from the campus can complete all aspects of the course. Assessments can be submitted electronically. These need to be accompanied by the hard copy version of the sign-off sheet indicating attainment of the practical skills.

An important part of each learning task is the online discussion. Students are advised that they need to use this while they are working on each of the learning tasks. Discussion topics are included in the specifications of the task. The teacher, however, may add more of these as necessary, as can the students. As each problem task will take 2-3 weeks to complete the teacher will have plenty of scope to add additional topics. The online discussion can be used by the teacher to facilitate sharing of information among the students, and to encourage sharing of ideas through comparison of experiences of the different environments in which the students work. The online discussion also enables the teacher to see the level of understanding the students attain, and to provide additional guidance on how to improve their level of understanding of the topic. This could include some guidance on strategies for learning the content materials through application, and on how to make the best use of the online discussions. It is recommended in the teacher's guide that teachers use the online discussion as an assessable activity.

The course materials are designed to enable the problem tasks and the online discussions to complement each other to provide an engaging and challenging learning environment.

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Application and Evaluation

The first trial application of the program at the Institute of Land and Food Resources, The University of Melbourne, ran into some difficulties that highlight some of the issues associated with online delivery. The difficulties were firstly that many of the students were at the beginning stages of computer literacy and did not know how to handle some of the computer processes, such as downloading files and saving them to a directory where they could be found again and used. Secondly, the equipment in the local college learning space was not up to the standard required, and many of the students did not have the type of equipment at home that was needed to run the program through the TAFEVC. These problems seemed to compound each other and students became very frustrated trying to work online through the TAFEVC. Another huge disincentive for students to work online was encountered when for long periods of time access to TAFEVC became temporarily unavailable. This meant that students could not access TAFEVC when they wanted to, when they were ready to learn. They were thus being denied what is one of the primary aims of online learning – accessibility. A questionnaire was completed by most of the students in the trial after the subject was completed. Table 2 summarises student feedback on technical aspects of the trial implementation. (Note that in the following table 'SA' refers to 'strongly agree', 'A' refers to 'agree', 'NS refers to 'not sure/does not apply', 'D' refers to 'disagree' and 'SD' refers to 'strongly disagree').

	SA	A	NS	D	SD
1. The way to use the online technologies was made clear to me from the beginning.		4		2	1
2. I experienced difficulties in gaining access to the online subject materials.	2	2		2	1
3. After the initial problems of connection were overcome, access to the online materials was consistent and effective.	1	2	1	2	1
4. The multimedia-based technology helped me to learn effectively.	1	3		3	

Table 2: Student feedback on technical issues

In order to overcome the problems associated with access students were provided with the program on CD. This provided students with good access to the course material, however it did not give the students the opportunity to download and submit files and also to become part of and contribute to online discussions. In a sense we were providing the students with an electronic book without the interactions we believed to be so important at the start. Student feedback on matters of interaction with other students, summarised in Table 3, indicates the limitations associated with the lack of the online discussion capability.

	SA	A	NS	D	SD
10. I had to consider several different points of view in the group discussion of the problem tasks.		3		2	2
11. I worked closely with other students on the group learning tasks.			1	4	2
12. I learned a lot from the other students while working on the group learning tasks.		1		3	3

Table 3: Student feedback on interaction with other students

The students generally felt very comfortable about the online course materials. They learnt the menu system very quickly and became adept at working through the course materials. They enjoyed the interactivity of some parts of the program and also the links to useful soil web-sites, which were provided online. The PBL approach also helped focus students on the problem at hand. Here was a problem, which they could realistically expect to encounter if they were pursuing a career in horticulture, which needed to be addressed. A number of students were so enamoured with the

PBL approach that they actually asked what became of Andrew and Julie (the two growers profiled in Soils online) and their venture. Other students commented that Andrew and Julie provided an experiential framework, which made it much easier for them to follow in completing their own soil investigations. Student feedback on the problem-based learning tasks is summarised in Table 4.

	SA	A	NS	D	SD
5. The best way to approach learning was clearly explained in the online subject materials.		4	2	1	
6. The problem situation had some features that were familiar to me.		5	1	1	
7. I found the problem situations challenging.		6	1		
8. The problem tasks enabled me to develop my existing knowledge of the topic.		5	2		
9. I gained a greater understanding of how to meet farmers' needs from working on the problem-solving tasks.		5	1	1	

Table 4: Student feedback on the problem scenarios

Conclusions

The PBL approach provided an effective basis for the design of this courseware. Using this approach, the starting point for design was a definition of the skills the student would need on completion of the course. These were defined as abilities that the student would need in the work environment rather than knowledge of a topic. The PBL approach encourages designers and teachers to focus on authentic, real-world, tasks that, as in the work environment, are not always clearly defined with one specific solution. An example in this program is the task of conducting a soil analysis on the student's own property. The skills in addition to content knowledge that the students learn relate to investigation, communication, IT, and dealing with ambiguity among others – all valuable skills in any professional environment.

The online resources enable teachers to use PBL effectively, even in a distance-learning environment. The difficulties of using the more open-ended learning tasks that are typical of PBL include management of the process and providing all of the resources that the students need to explore the dimensions of the task. The online materials provide access to all content materials at the click of a mouse, access to other sources such as the Victorian Resources Online and CSIRO sites, and a means of managing the process through the online discussions and regular assessment tasks. Students can explore the content for problem-solving and use the online discussions to share ideas and information. The realistic nature of the problem tasks is intended to provide a stimulating and motivating environment for learning.

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VIDEO STREAMING OF LECTURES VIA THE INTERNET: AN EXPERIENCE

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Abstract

This paper reports on an investigation into methods of efficiently introducing video streaming into subjects in a large Economics and Commerce faculty. Several software options were investigated before finally settling on RealSystems. The paper provides a brief review of the background of the project followed by a general overview of video streaming. The challenges we identified in effective video streaming are outlined together with a discussion of possible solutions. The paper concludes with an outline of key indications from our investigation of this mode of subject delivery.

Keywords

video streaming lectures, audio streaming lectures, multimedia

Background

Teaching in the higher education sector is moving away from the information transfer mode of the past towards a student-centred, contextually meaningful framework for subject delivery that enhances knowledge development, (Barr & Tagg, 1995). There is a recognition that student learning styles vary and that opportunities should be provided for students to learn in a range of different contexts, (Ramsden, 1992). A key factor facilitating this move has been electronic learning technologies that have increased the range of tools now available to academics in their teaching. In this paper we describe the introduction of audio and video streaming technology in the Faculty of Economics and Commerce at the University of Melbourne.

As the use of computers and the Internet has become more widespread in the community so too has its use by students in their studies. Students in the Faculty of Economics and Commerce have indicated an increasing preference for using the Internet to obtain resources for their learning.

Counters on subject web pages have shown that most students frequently referred to these pages during the semester. Importantly, in terms of pressure on faculty computing infrastructure, close to 70% of students accessed the subject web pages from sites off-campus.

Concurrently with the use of the Internet has come a demand for a wider range of learning materials to be presented on subject web pages. In particular, students ask for lecture notes to be published on the web so that they can correct the notes they have taken or so that they can catch up on lectures that they have missed. While skeleton lecture outlines are seen as a useful tool in directing reading for the lecture and tutorial program we do not see the educational value in printing whole lectures verbatim on the web. There is insufficient interactivity in this and there does not seem much to be gained that would not be equally adequately provided in paper form as a workbook or text. Electronic learning materials are best employed when they either accomplish that which is not possible in paper form or where they provide a similar function more efficiently. We wanted students to be actively engaged in the learning process. The provision of the lecture in its entirety though audio and video streaming is seen as one way in which students could be provided with the facility to review lecture material they did not understand the first time through, to add to or amend the notes they had taken in the lecture or to take lecture notes from any lectures they had missed. This requires more student interactivity than the provision of lecture notes and promotes active engagement with the subject. Active engagement stimulates deeper approaches to learning, (Ramsden, 1992; Meyer & Jones, 1993). Several studies indicate that note taking contributes to higher retention and understanding, (Peper & Meyer, 1978; Weiland & Kingsbury, 1979) and that the provision of a full set of written notes by the lecturer contributes to student passivity (Annis, 1981; Kiewra, 1989).

A second reason for the introduction of video streaming was that the faculty's Centre for Actuarial Studies within the Department of Economics had a number of off-site students, many of whom are located in the Asia Pacific area, who required access to videos of the lectures. In the past these students had received copies of videos of the lectures in the mail. Video streaming would avoid the necessity of this cumbersome form of delivery. The Centre has close ties with the Institute of Actuaries where the use of video streaming is currently being explored in relation to its use in the ongoing professional development of Institute members. The third reason for the introduction of video streaming was that there was an identified need to provide students with up to date comment on current issues of importance to the economy. Visitors to the faculty and incumbent academics were a valuable source of this type of comment. The aim was to interview experts on current issues and stream these for lectures and to students as an enrichment to their text and lecture-based materials.

In 2000 the faculty experimented with the audio streaming of lectures. Students could go to the web page and click on the relevant lecture to listen to it again. Audio streaming of lecturers was undertaken in one second year subject of 350 students in the Department of Management Faculty in semester 1 and extended to the first year Department of Economics subject, Introductory Macroeconomic with 1250 students in semester 2, 2000. Audio streaming has been further extended to two additional subjects in the Faculty in 2001.

Student use of audio-streamed lectures was high in 2000 and 2001 judging from the log of students accessing the lectures. Approximately 15% of students used the audio streaming facility during the semester. This percentage increase to around 25% in the weeks leading up to the examination period indicating that many students see this as a useful aid to revision. It was efficient from the lecturers' point of view in so far as the only additional requirement from them was to arrange for the audiotapes to be delivered to the faculty Teaching and Learning Unit for streaming.

Efficiency from the student perspective was achieved in that students reported that they were able to catch up on lectures and to revise at times more suited to their life style. Much student learning happens outside class, yet lecturers concentrate primarily on what happens in class (Stark & Lattuca, 1997). The capacity to build on outside class learning through audio streaming was a step forward in providing learning support to a wider range of students than had been previously possible. The confidence we gained through audio streaming initially was valuable in taking the next step to video streaming.

The educational advantages of video streaming are that by actually seeing the lecturer presenting the materials students can pick up more readily on visual signals related to the body language of the lecturer and the video stream provides an enhanced perception of interaction between the student and the lecturer. Student attention is also more readily maintained when there are visual as well as audio prompts. In addition there is the ability to cater to the needs of a diverse range of students. Student learning styles and approaches vary widely and audio video streaming of lectures provides an alternative to face to face lectures that is likely to suit particular groups of students not well catered for by existing 'live' or audio-only lectures (Massey & Zemsky, 1995; Sosin, 1997).Those students from non-English speaking backgrounds may find the lectures easier to understand when the visual and verbal cues are combined in video streaming. Important also is the facility to be able to see how a lecturer constructs a diagram as well as key points of intersection and the effect of a movement of one of the curves. This last is a particularly valuable element in teaching and understanding economics.

The Information Technology staff in the Faculty Teaching and Learning Unit and in the Department of Economics carried out an investigation of the feasibility of introducing video streaming into lectures for both on-campus and off-site students in the Centre for Actuarial studies. The faculty experimented with streaming of small video clips introducing key elements of assignments in two subjects in semester 2, 2000 and were encouraged by the positive response from staff. As a result we applied for and received a Teaching and Learning (Multimedia Electronic Technologies) grant to introduce video streaming into two subjects in the Department of Economics in semester 2, 2001. The streaming technology had improved significantly during the year and we now felt that video streaming was more likely to be effective than we had thought early in 2000.

The term, off-site students, encompasses the broad range of students who wish to access teaching and learning materials from sites outside the university. Students who live in Melbourne as well as rural and overseas students all wish to have access to these materials without having to physically come into the university. It is not the intention, nor indeed the experience, that audio or video streamed lectures replace face-to-face lectures. They are intended to enhance student learning through an alternative context for lectures. 'Live' lectures are clearly a first preference for a range of reasons including the social aspect to attendance at a live lecture and a greater immediacy and the potential for interaction. However, audio and video streaming of lectures clearly has a niche market for distance education students in the Faculty and also for local students for the reasons discussed.

The remaining sections of this paper provide a general overview of video streaming followed by sections on creating and delivering streaming videos via the Internet, problems with video streaming, using RealSystems for video streaming, overcoming video streaming problems and complementing the video presentation with other visual aids. The paper concludes with an outline of key indications from our investigation of this mode of subject delivery.

Overview of Video Streaming

In previous years a key barrier to incorporating multimedia such as video and audio into web pages for delivery via the Internet has been the amount of data that has to be transferred over the network. Using conventional methods, a two-hour lecture video will take an intolerably long time to download via a typical home Internet connection using a 56Kbps modem connected to a telephone line. As well as taking up a huge amount of bandwidth (network space), the downloaded file will most likely take up a large percentage of the hard disk space of the computer to which the file is down-loaded. Only once the download is complete, may the file finally be watched hence downloading will need to begin long before the intended viewing time.

To overcome these problems, video-streaming technology is used. The raw video files are 'encoded' in such a way so that the file is compressed, resulting in a smaller file size. Also, the resulting file format allows the file to be opened and played as it is downloading, hence eliminating having to wait for the download to complete before viewing. Finally, the physical file is not downloaded, meaning that hard drive space is not taken up on the downloading computer.

Creating and Delivering Streaming Videos via the Internet

The entire process of providing steaming videos can be broken down to three major steps. Each step is achieved by using software from one of the multimedia software companies. The main players in the multimedia streaming creation field are currently QuickTime, RealSystems and Windows Media. The three steps are:

1. Create a video file to stream. To create a video for streaming, a raw video file (captured using a digital video camera or digitised from a conventional video tape) must be encoded. To do this, software is available which will compress the file to a smaller size and format it in such a way so that the file may be streamed to a viewer via the Internet.
2. Deliver the encoded file for viewing. Once the file has been encoded, it is ready to be delivered over the Internet. The encoded file is uploaded to a 'Streaming Server'. This server accepts requests for a video from a viewer, retrieves the requested video and begins streaming it to the viewer. The streaming server may be a standard web server but to take full advantage of the functionality of streaming technology, a dedicated streaming server should be set up by installing server software that is also available from the above-mentioned companies.
3. Viewing the video. A video is 'streamed' to a viewer when they request the video from the server. In order for viewers to watch streaming videos, they must have the appropriate player (Real systems, Windows Media or QuickTime). This software is usually freely available from one of the multimedia companies. If the player is already installed, it will be started automatically; if not, the user will be prompted to download it from the appropriate company's web site.

Using RealSystems for Video Streaming

After careful product research and a review of several samples of video streaming created from QuickTime, Windows Media and RealSystems, it was decided to implement video streaming. QuickTime was not adopted as the system does not allow to multiple bandwidths from one source file. For example using QuickTime we would have to create a separate streaming file for each connection type that we hope to stream to, i.e. one for a 56 Kbps modem connection, one for a LAN connection and so on. This adds to production time problems and increases the size of storage required. Windows Media has the disadvantage of taking much longer to deploy and it is more complicated to produce the streamed video. Video quality was not found to be as high as Real Player; however, audio quality in Windows Media was found to be higher. RealPlayer was the system finally chosen for several reasons. It was easy to produce the streamed material on the server and it could stream to multiple bandwidths from one source file cutting back on deployment time and storage space. It is relatively straightforward for students to access the streamed material using this system and video quality is the highest of the three systems.

Three RealSystems products were used to create the Department's video streaming system. These products are outlined below.

RealProducerPlus

This software encodes a raw video file (in this case, an AVI file) or input directly from a media device such as a digital camera into a RealMedia file (.rm extension). The viewer may request to watch the video at anytime. Alternatively, a live broadcast can be created directly from the media capture device without saving to a file. In this case the viewer may only watch the video as it is being broadcast, the video may not be accessed later. RealProducerPlus comes with a number of wizards which makes the encoding process easy. With built-in default settings for a number of pre-defined audio and video types there is no need to for the user to specify individual settings such as capture frame rates and audio sampling rates. For example, possible audio types are voice-only, music or stereo and possible video types are normal-motion or smooth-motion. It is possible to override these wizards and apply custom settings.

One advantage of RealProducerPlus over other similar software is that it is capable of creating a single encoded RealMedia file containing a number of different streams based on target connection speeds, using RealSystems' SureStream technology. This means that a different stream will be downloaded to the viewer depending on their connection speed to ensure the optimal viewing quality for that particular connection speed. The possible target connection speeds are:

- 28 Kbps modem
- 56 Kbps modem
- Single ISDN
- Double ISDN
- Corporate LAN
- 256 Kbps DSL/Cable Modem
- 384 Kbps DSL/Cable Modem
- 512 Kbps DSL/Cable Modem

The downside to this feature is that the size of the file increases for each extra stream that is created within the file. An example is a 2 hour 10 minute AVI file encoded to a 323 MB RealMedia file when only two connection streams were chosen whereas the same AVI encoded for all eight connection streams resulted in a 600 MB RealMedia file. It would seem that, in order to conserve file storage space on the server, it would be best to know the general connection speed of the intended audience and restrict the encoded file to a limited number of connection streams.

In order to quickly create an encoded RealMedia file for video streaming with RealProducerPlus, we used one of the wizards. The steps involved are:

1. Select an encoding wizard, Encode from File, Encode from Media Device or Live Broadcast.
2. Enter the raw video/audio source, i.e. file or media device.
3. Enter Video clip information such as author, date, descriptions.
4. Select the target audience streams.
5. Select the audio type.
6. Select the video type.
7. Select an output source, file or server to stream from for live broadcasts.

Other features of RealProducer Plus are:

- web page creation wizard to generate a web page to embed the video in;
- a Bandwidth Simulator that generates a preview of the video as it would appear on various connection speeds; and
- a streaming video editor which allows the editing of RealMedia clips.

It was found that the encoding process was simple and intuitive. Encoding was quick and occurred for the most part in real time. The resulting files were of a reasonable size. The added Web Page Wizard, Bandwidth Simulators and Clip Editor were handy tools to assist in the creation of a professional looking final product.

RealServer Basic

Streaming videos may be served from a standard Web server using HTTP protocol. However, a RealServer must be used to stream live broadcasts and to make the most out of RealSystems technology such as SureStream (allowing multiple connection streams in one file). This software from RealSystems is free to download and may be used for up to a year free of charge. The Basic version allows streaming to up to 25 concurrent users. RealServer Plus is quite costly at US$2000 but allows up to 60 concurrent users and has some added features. It is available for all the major UNIX platforms and Windows NT and 2000.

The server is simple to set up and requires minimum network knowledge to get up and running. The server is administered through a web-based console. This console allows the administrator to configure server settings, set security, monitor performance and set up live broadcasts. The streaming server will usually work with a web server to deliver streaming content. The web page will link to a .ram or .rpm file that will contain information referencing RealMedia files requested by the user, located on the streaming server. For more technical information regarding the Real Systems Server refer to the Real website and browse the RealServer Administration Guide.

RealPlayer 8 Basic

In order to watch videos or listen to audio streamed from a RealServer, a RealPlayer must be installed on the viewer's computer. A free version of this player, RealPlayer 8 Basic, is downloadable from the Real website. This is available for UNIX, Windows 95 upwards and the Mac. The player has similar functions as a real video/ stereo with control features such as Play, Stop, Pause, Fast Forward and Rewind. The screen size is adjustable from a default size to full screen. Equalisers are also available to adjust sound volume and quality. The player may function as a stand-alone application or be embedded within a web page.

Challenges in using Video Streaming

The Faculty of Economics and Commerce is using video streaming in three ways. First, to provide web page embedded videos to off-site students in the Centre for Actuarial Studies, which reflect the experience of being in the lecture theatre. This means the video shows the lecturer talking at the front of the theatre and also the PowerPoint slide presentation, which complements the lecture. It is not important whether or not the fine details of the lecturer can be seen with great quality. What is important is the voice of the lecturer, the general view of the lecture theatre and the slides that are being presented are clear to students. Second, to provide streamed videos of lectures for Melbourne-based students. These students are able to attend 'live 'lectures and use the streamed lectures for revision of the lecture as discussed earlier. Third, to provide short 10 minute interviews with economists to illustrate key issues in current economic events. These provide the basis for tutorial problems or assignments and are used within lectures. They are available on the subject web pages.

From the trials conducted in the Faculty and the Department of Economics it is clear that the problems identified with video streaming do not stem from creating and delivering the videos. There are two principal challenges. These are related to Internet connection speed and the visibility of all teaching materials presented in the 'live' lecture.

Internet Connection Bandwidth

Although, the encoding process compresses the raw video file, the resulting file is still quite large. The video is viewable at a reasonably high quality with a LAN type connection. However, the quality suffers when a video is requested from a user using a low speed Internet connection (i.e. a typical 56 Kbps modem). The amount of data that needs to be sent to generate a good quality video will often exceed the capacity of a 56 Kbps modem. The audio stream quality will not be affected but occasionally the video may appear jerky and on rare cases stop momentarily. Clearly this would be detrimental to student concentration and learning. For as long this quality problem remains the faculty will refrain from using video streaming in any directly assessed piece of work and will also to continue to supplement video streaming for distance students with tape video mailed to these students. However, with improving network technology, higher capacity network connections will progressively become the norm and will eliminate the problems associated with insufficient bandwidth.

In order to establish how the audience would be viewing the streamed online lectures, an online survey was delivered to students in the Actuarial studies distance cohort requesting that they provide information regarding their connection speed to the Internet. Sixty percent of returns indicated that they had cable connection with 23% being on 56 Kbps modems. Based on the collected information, the RealMedia file was encoded using the RealSystems SureStream technology to provide a number of connection streams on one file. The categories of connection speed used by the students were defined in the survey and it was possible to create streams only for the relevant connection speeds, rather than the entire possible eight streams, hence reducing the final file size. The SureStream technology is capable of detecting the connection speed of the requesting user so that each viewer is presented with a stream that represents the optimum quality capable for that speed. There are only 25 students in the actuarial cohort so it was possible to keep track of the connections speeds required. However, when video streaming was implemented for the larger group of over 600 students in Intermediate macroeconomics in semester 2 2001 this restriction was removed and the video was streamed to all possible connection speeds in order to ensure adequate access. This requires more storage space but the access advantages are seen to outweigh the relatively small cost of increased storage space.

The various connection types available to consumers are changing rapidly. Telstra has now made available an ADSL (Asymmetric Digital Subscriber Line) service to home users that may soon replace the traditional 56K modem as the main method of accessing the Internet from home. The ADSL service is delivered via the standard home telephone line and the Internet is always connected to the home PC meaning there is no longer a need to make dial up connections to the internet. The price of the service is around $70.00 per month for home users which is not unreasonable considering many internet service providers are charging as much as $2.50 per hour for Internet access with additional hours costing significantly more.

Clarity of Displayed Images

Multimedia guru, Tim Kennedy, has been quoted several times as saying streaming technology in its current form is about access not quality. Although the videos viewed using video streaming are not of DVD quality, they are sufficient to allow students access. It is a matter of time before networking technology makes it possible to deliver the best quality video over the Internet but in the meantime, the solution is to minimise the problems with video streaming.

Experience with audio streaming in 2000 indicated that this technology was effective and found to be useful by students using current networking technology. The lecturer's voice can be clearly heard even using a 56 Kbps modem. The video image however is relatively small resulting in low legibility of slide materials presented by the lecturer. A key problem then is the visibility of the slides used in lectures. The following solutions to this have been implemented in 2001.

- Original Capture Quality. A major contributing factor to the final quality of the streamed video is the quality of the original captured video. Lighting needs to be carefully considered if the video is not taken in specialist lecture theatres. In addition in order to make the slides legible within the video frame itself the text used should be of a larger font and be of a dark colour on a light background. The user is also able to utilise a feature of RealPlayer that allows the video to be displayed at full-screen size. Although this magnifies the details of the video, flaws in the image are also be magnified. However, even under these circumstances, the legibility of the video streamed slides is likely to be limited
- As noted earlier, it cannot always be guaranteed that the slide presentation in the video will always be of a viewable quality as network connection speeds may change and system resources on the user's computer could affect the level of buffering. To ensure that the slides will always be viewable, it was decided that the video and the PowerPoint presentation would be presented together within one web page. To do this, the PowerPoint presentation was obtained from the lecturer and converted to HTML using the HTML conversion function available within PowerPoint. A web page was written which was split into two frames. The HTML version of the slide presentation was embedded in one frame of the web page while the other frame contained the streamed video. The slide may be viewed with all the associated images or simply as texts hence minimising download time. As the video continually plays, the viewer is able to see the slides changing in the video even if the details of the slide are not clear. The lecturer is also encouraged to state clearly what slide is currently being viewed. When the slide changes in the video, the viewer can manually change the slide in the HTML PowerPoint presentation on the web page.

There are also some peripheral problems associated with video streaming. First, students have to download RealPlayer. While computer-literate students will do this easily others who are less competent in this regard may experience difficulty. Second, some free Internet Service Providers do not allow users to view streamed video so students may have to change providers in orders to be able to access the streamed video. Third, there may be some loss of sound quality as the streaming system detects the type of modem students are using and provides a smaller file which result in some quality loss.

Evaluation and Discussion

Several studies have been conducted in relation to student perceptions of the effectiveness of video as a learning tool, (Hecht & Klass, 1999; Ivers & Baron, 1994) indicating that students find the facility useful. In the Economics and Commerce Faculty, audio and video streaming of lectures is in its infancy and results from a comprehensive evaluation has yet to be completed. Logs of student use have been kept and in semester 2 2001 a survey has been conducted of student perceptions. Preliminary analysis of the survey indicates that 92% of students who access the video-streamed lectures in Intermediate Macroeconomics agreed that this was a useful learning resource. 83% agreed that they would use this resource on a regular basis and the same percentage agreed that they preferred video streaming to audio streaming alone. Disturbingly 33% of students agreed that they would use video-streamed lectures to replace live lectures occasionally. Around 42% of students reported missing lectures occasionally and of these 43% of students reported that they occasionally missed lectures due to work commitments and a further 14% missed lectures due to subject clashes. Given that attendance at 'live' lectures is one avenue through which students connect to the course and to the university it is hoped that this use of the facility is limited to occasional use rather than regular use. Indeed this has been the experience in the faculty to date with lecturers reporting no significant decrease in the numbers of students attending.

An issue that the faculty frequently confronts is the minimum technical knowledge required for students to access the electronic learning technologies offered by the faculty. In order to receive streamed video the student must be able to access the Internet, download the streaming media, install the player, and perhaps configure the machine for optimal performance. This typically causes problems for around 5% of students – a not insignificant number in large subjects in the faculty. The issue of student's technological expertise also raises the question of what minimum hardware and software can we expect students to have in order to be able to participate effectively in the course. Over time the issue of expertise is anticipated to be largely resolved as all students develop the necessary skills. However, the issue of minimum hardware and software requirement is likely to be a constant given the speed of technological change.

A review of the video streaming products available has led to our adoption of the RealSystems suite of products was identified as providing the simplest and best quality results for video streaming. The process of creating and delivering streaming video was quick and simple at a reasonable cost. The SureStream feature allows streaming to viewers of different connection speeds with a single file hence reducing production time. The quality of video when viewed from a high-speed connection was very good but this diminished with low-speed connections. However, it was decided that for the purposes of delivering lectures, with good audio delivery, the video image quality was sufficient even with a low-speed connection. By combining streaming video with the web page embedded PowerPoint slides, off-site students were provided with the best interface to simulate the feeling of physically attending the lectures. As the slides did not have to be viewed in the video, the size of the video window could be made smaller to further minimise the size of the video to be down loaded.

Video streaming, in its current form, proved to be a suitable technology to deliver lectures to off-site students and for the provision of short video kernels for use in the tutorial and lecture program of two large economics subjects in 2001. With expected future developments in networking technology, the quality of streamed video will soon be of even higher quality ensuring video streaming a promising role in the delivery of online education.

Experience in audio streaming and the subsequent move to video streaming in the faculty of Economics and Commerce is seen as a natural progression in the provision of a world class learning environment for our students. We believe we are the first faculty in the University to integrate the use of video streaming in the manner described. Clearly the effectiveness of video streaming in improving student learning and in improving the efficiency of subject delivery requires further evaluation and this will be the focus of developments in the faculty in 2002.

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ACADEMIC AND INSTITUTIONAL ISSUES RELATED TO THE PLANNING AND IMPLEMENTATION OF A MULTI-DISCIPLINARY ROLEPLAY-SIMULATION INVOLVING COLLABORATION ACROSS INSTITUTIONS

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Abstract

The Mekong e-Sim involved more than 140 students across Australia and overseas participating in an online roleplay-simulation over a four-week period. Set in the Mekong region of South East Asia, it allowed for highly charged debates over development issues arising from clear-cut differences and conflicts in values and interests. The geography and engineering students who participated were enrolled in three different subjects at four institutions. The e-Sim was the product of a 'grassroots' alliance between four collaborators at different institutions. The drivers for forming the alliance were the development of subject specific learning outcomes, promoting linkages between students, internationalisation of the curricula and educational research. The e-Sim design created a high level of student interdependence for pedagogic reasons, which also led to a high degree of interdependence among staff. This created a need to negotiate and agree to common practices for teaching and assessment in specific areas. Issues regarding access to institutional resources for students across different institutions also arose. An awareness of these issues is needed to ensure that 'grassroots' collaborative educational activities are designed to meet their objectives and can evolve to be sustainable.

Keywords

collaboration, online teaching, roleplay, simulation, alliance, multi-disciplinary

Introduction

The development of collaborative projects between universities has been encouraged by the demands created by the current economic restrictions confronting all higher education institutions. However, collaborative projects can also be driven by the need to foster learning communities between staff and students at various institutions. Collaborative educational projects can disseminate teaching ideas, allow more efficient use of scarce resources, open up access to different resources and make teaching enterprises public. In addition, inter-disciplinary educational projects create opportunities for students to transfer skills and knowledge and to develop alternate perspectives. The incorporation of student groups with diverse backgrounds can significantly enhance learning outcomes from teaching and learning tools such as roleplay-simulations that have a particular strength in allowing for the integration of student knowledge and perspectives.

Electronically supported roleplay-simulations (e-Sims) for education have been used since the early 1980s for political science students (Vincent & Shephеrd, 1998; Wilkenfeld, 1983). They have only recently become more widespread in political science (Linser & Naidu, 1999; Kinder, Fardon & Yasmeen, 1999) and occasionally in environmental decision making (McLaughlan & Kirkpatrick, 1999). The use of an e-Sim is still very much innovative particularly with regard to being able to effectively allow students to share their perspectives and knowledge in an online environment and then develop understandings through online debriefing. A rich learning experience can be created when students with different disciplinary backgrounds and knowledge participate in an e-Sim. This creates a demand for collaborative educational projects that can bring together students who may be distributed in different locations into a learning community.

The aim of this paper is to describe the formation of the educational alliance, which developed the Mekong e-Sim, and the issues that were faced during the planning and implementation of a 'grassroots' multi-disciplinary, cross-institutional educational activity. This analysis is based on data collected as part of the evaluation of the project and represents the experiences of all team members. If these types of projects are to be sustainable, strategies to address and manage these types of issues need to be developed. This is particularly important for alliances that arise from shared interests and commitment but have limited resources to cover any workload impacts due to the venture.

Project Aims

The Mekong e-Sim has involved collaboration between staff and students at the University of Technology, Sydney, Adelaide University, University of Sydney, Sepang Institute of Technology, Malaysia and the University of New England. The project involves developing the Mekong e-Sim and evaluating and identifying aspects of staff and students collaboration.

The e-Sim is an electronically supported roleplay-simulation, which can be used by students who are geographically distributed. The Mekong e-Sim is based around a realistic international problem that would allow specific knowledge and generic skills to be developed in students from a variety of cultural and professional backgrounds. The specific learning objectives of the Mekong e-Sim were for students to:

- Identify the political, social, economic and scientific dimensions to decision making in the context of natural resource management conflicts.
- Identify the responsibilities and appropriate responses for characters in the roleplay-simulation.
- Develop communication, research, critical thinking, negotiation and decision-making skills and an appreciation of cultural differences and approaches.
- Utilise information technology and telecommunication skills.

A feature of the e-Sim is the focus on collaborative learning between students with diverse backgrounds. Creating this diversity of student groups requires collaboration between staff and the development of shared practices. These staff may have diverse disciplinary, institutional, teaching and learning cultures. Therefore, it is appropriate to seek to understand issues associated with collaboration among staff from different disciplines and institutions.

The Mekong e-Sim

The Mekong e-Sim was run for the first time between March and April 2001. It comprises four stages: briefing, interaction, forum and debriefing.

The *briefing* stage involves participants becoming familiar with the e-Sim structure, geographical context, assessment and task requirements and the technology used in the e-Sim. It also involves them researching, adopting and then publishing their persona identity. Within the e-Sim, 39 personae (groups) represented stakeholders who can influence or are influenced by development activities in the Mekong Basin. These comprised Government agencies and ministries, multi-lateral funding agencies, Non-Governmental Organisations, Business corporations, media and People's Organisations. Each persona comprised four members with half the groups comprised of cross-institutional and/or cross-disciplinary members. This briefing stage occurs over a two-week period.

The *interaction* stage comprises interactions between members of a persona and between different personae. This occurs while carrying out their tasks, preparing for the forum stage and responding to any events or actions by other persona. The main communication medium for this stage is email and posting to a group discussion area. This ran for 17 days and a total of 1600 emails were sent.

The *forum* stage involved four online public forums with specific terms of reference where personae could post submissions and responses. The three forums, modelled on public inquiries, focussed on the Nam Theun2 Dam, Tonle Sap Management and Regional Transport Initiatives. Another forum was set up to solicit AusAid funding proposals from personae. The four forums had between 24 and 172 messages posted, indicating there was extended debate on some topics. The forum stage lasted two days.

In the *debriefing* stage participants identified what they learned as a consequence of participating in the e-Sim. As part of the debriefing, the participants post online a structured analysis of a learning event that occurred during the e-Sim. A face-to-face debriefing was also conducted at each of the sites. This was a structured process using guided recall, reflection and analysis of the experience (Lederman, 1992). Students were required to write a debriefing report that demonstrated their understanding of the various factors that influenced development issues and strategies adopted by their persona.

Teaching Context

The Mekong e-Sim constitutes part of the curriculum of three different subjects in the four participating institutions. These subjects are discussed below.

Asia-Pacific Development, University of Sydney

The Year III geography semester unit of study on Asia-Pacific Development deals with processes and consequences of development and its social, environmental and political ramifications in the dynamic Asia-Pacific economies. It involves approximately 60 third year students drawn from a range of faculties, including arts, science, education and economics. Forty of these students undertook the unit in normal lecture-practical mode, while 20 undertake the unit in Field School mode, involving a five-week intensive field-lecture program in Southeast Asia.

Technology Assessment, University of Technology, Sydney

This subject aims to develop students' understanding of relationships between technology and economics and the environment, politics and society, particularly within a public policy framework. Approximately 20 third-year engineering students drawn from sub-disciplines comprising civil, environmental, telecommunications, computer software engineering and mechanical engineering were involved.

Environmental Engineering II, Adelaide University & Sepang Institute of Technology, Malaysia

The subject covers fundamental concepts in environmental engineering such as environmental systems, environmental decision-making and sustainable development. Topics in river management and rehabilitation, water quality and air quality are also addressed. Students are also expected to show an awareness of the economic, social, political, legal and environmental context of engineering projects, and sensitivity to the needs of the community. The student cohort comprises approximately 60 second-year engineering students from the Civil- and Civil and Environmental-Engineering programs.

Drivers for the Alliance

The Mekong e-Sim alliance relies on the shared interest and commitment of individual collaborators to provide a suitable educational experience for students' needs while meeting their own professional needs. In general the collaboration was motivated by a shared interest in developing a learning experience that would involve students in collaborative learning, embedded in real-world problems that would support student understanding of multiple perspectives. The e-Sim was seen to provide a relatively low-risk environment in which students were free to learn by doing. Project members recognised the advantages for themselves and their students that would derive from collaborating to develop and teach the Mekong e-Sim.

Each of the subjects that contributed to Mekong e-Sim sought to develop students' understanding of multiple perspectives. Participation in the Mekong e-Sim afforded an opportunity for students to engage in a learning experience that included the consideration and adoption of multiple views (i.e. economic, social, technical and political dimensions) of issues relevant to development and technology within the region.

The use of electronically supported roleplay-simulations (i.e. e-Sim) is innovative and still very much an area of development and research. The e-Sim has been designed to provide opportunities for the study of both practice and pedagogic issues that will allow it to be used as a basis for extending knowledge within this area. The inclusion of students and collaborators who are geographically distributed and from multiple disciplines and institutions is a fundamental requirement for that research agenda.

There was an expectation that the e-Sim would promote linkages between students. The subject Environmental Engineering II is taught both at Adelaide University and Sepang Institute of Technology (SIT) due to a twinning arrangement between the institutions. The subject co-ordinator hoped the e-Sim would promote positive interaction before the students from SIT would complete their studies at Adelaide University in the following two years. The subject co-ordinator of Asia-Pacific Development intended that students who had undertaken the Field School in Asia would share their experiences through the e-Sim with other students who were completing the subject through coursework in Sydney.

There is always a need within education to promote effective teaching and learning practices in a cost-effective manner. Several of the collaborators had trialed roleplay-simulations previously with their students and found them to be effective (McLaughlan & Kirkpatrick, 1999; Maier & McLaughlan, 2001). A roleplay-simulation conducted in 1999 between engineering students at UTS and political science students at Macquarie University had also yielded positive learning outcomes. The collaborative nature of Mekong e-Sim provide an opportunity for staff to share reflection on the design and effective implementation of roleplay-simulations and to learn collaboratively themselves. The collaborative development of Mekong e-Sim allowed for specialist skills and knowledge and sharing of scarce resources.

There was also an intention among the collaborating developers that the e-Sim would promote internationalisation of the subjects concerned, both through the content of the curriculum and through student interactions. Internationalisation of the curriculum for the engineering subjects was achieved by focusing on the Mekong Region of Asia while the incorporation of the perspectives of international students has occurred to a degree with the involvement of the SIT students. There is scope for further internationalisation.

Structure of the Alliance

An inter-firm alliance can be defined as an organisational structure to govern an incomplete contract between separate firms in which each firm has limited control (Gomes-Casseres, 1996). A contract is termed incomplete when it does not specify what to do under every conceivable situation and hence the participants need to engage in joint decision-making to deal with unforseen circumstances. Our collaboration has these characteristics. It is very much a 'grassroots' driven alliance initiated by staff at the contributing institutions. Due to nature of the alliance it was necessary to create an educational product (the Mekong e-Sim) that would have a minimal impact upon the existing course structures, have low requirements for the re-distribution of resources between institutions and consequently a relatively low impact if the educational product did not meet its objectives. Collaborators within the alliance brought a mixture of subject content knowledge, educational development and evaluation expertise, familiarity with the teaching and learning tool used and control over the curriculum where the educational product was to be embedded. The e-Sim was designed to have a centralised set of resources and be a 'virtual space' where students shared the online roleplay-simulation experience through Internet connections from their own site. All students engaged in the same assessment tasks, which were marked by staff from their own institution. The relationship between the Mekong e-Sim experience and the curriculum at the host institution could then be utilised differently within each of the subjects where the students were enrolled.

The organization of the alliance has features similar to other networked learning communities reported in the literature. CollabU, a graduate seminar is based around students from five universities sharing resources and collaborating on activities conducted via online discussions around five themes related to technology in education (Breuleux, Owston, Laferrière, Resta, Hunter, Estes & Awalt, 1999). It is a multi-site, international, distributed, collaborative project driven by the shared interests of collaborators whose interactions were generated from interaction at a conference. A more formally structured alliance is The Global Seminar project spearheaded by Cornell University, which involves an educational consortium of at least eight internationally, based universities (Global Seminar, 2001). Each institution shares equal ownership of a variable 1-3 credit point University seminar subject, sponsored through the respective University and co-ordinated through Cornell University. Staff at each university are responsible for hosting one video broadcast of a seminar and play a leadership role when the seminar originates from their site. Cornell University co-ordinates the project by hosting the website server, discussion board, reviewing and publishing instructional material and other management responsibilities. Costs are shared across those institutions that have the ability to pay, with other institutions covered by grants and contributions from consortium members. This model requires a much higher level of institutional commitment than that available to the members of the Mekong e-Sim

A key feature of such alliances is a focus on constructivist approaches to learning where the richness of the learning experience is partly dependent on the knowledge and perspectives of participants bought into the alliance. Staff from both the CollabU and the Global Seminar alliances collaborate around the generation of learning experiences for students at their respective institutions. The Mekong e-Sim project shared a similar focus and was also guided by principles of learning that valued collaborative and experiential learning approaches.

To ensure the desired learning outcomes and needs of the collaborating members were met, it was considered necessary to establish shared protocols about the e-Sim and the ways it would be embedded into the respective subjects at the various institutions. It was agreed that the e-Sim should entail the same workload and contribution towards assessment in each subject. This was set as 40 hours and between 35-50% of the subject credit point allocation. Student assessment comprised both individual and group tasks. Previous experience with a roleplay-simulation where different groups of students were not assessed in a consistent way indicated that this led to a lack alignment of student goals resulting in a reduced level of collaboration between cohorts (McLaughlan & Kirkpatrick, in press). Therefore, a common set of assessment criteria and tasks was used for students across institutions. All project members acknowledged the desirability of a high level of student interdependence and collaboration across diverse student populations. This required students at different sites to form groups and share responsibility for tasks. As a consequence the e-Sim has resulted in shared student learning and shared academic practice among the staff involved.

Resourcing the Project

The project developed from conversations between two of the project members at an engineering education conference. The presentation of work associated with an e-Sim relating to the management of contaminated site (McLaughlan & Kirkpatrick, 1999) stimulated discussion and led to the initiation of an e-Sim in Engineering at Adelaide University (Maier & McLaughlan, 2001). Those involved recognised the value of working collaboratively to develop a distributed, shared learning experience and planned the Mekong e-Sim. During the following year a small amount of funding supported travel for a face-to-face meeting to begin planning. The visit was timed to coincide with the debriefing phase of the Adelaide University roleplay-simulation. The debriefing phase of roleplay-simulations is critical in supporting student learning and the face-to-face meeting provided an opportunity for the two staff to develop a shared approach to the debriefing. The meeting also focused on clarifying the approach that would be used for analysing student assessment tasks. Other collaborators were invited to participate in the e-Sim and preliminary talks progressed. One of the collaborators and a colleague were awarded an institutional teaching development grant that funded development of the e-Sim. The final core project team comprised three academics who were the subject co-ordinators of the subjects involved who contributed substantive content expertise and would be responsible for managing the e-Sim at their own institution and a fourth member who was responsible for design and implementation of the evaluation of the project. The project was coordinated by Robert McLaughlan who had substantial experience in designing and teaching e-Sims. A two-day meeting between all participants was held one month before the commencement of the e-Sim to clarify roles, responsibilities and set timelines for the e-Sim design and evaluation. At this meeting scenario design was finalised and evaluation of all aspects of the project was negotiated. Because of different arrangements at each institution there was variation in the extent to which each team member would be actively involved in teaching via the e-Sim and assessing student work.

The financial resources (~$11,000) spent to date have been largely expended on travel to allow face-to-face planning meetings and the collection of student evaluation data. The major resource involved in the e-Sim has been the labour involved in developing and administering the e-Sim. It is estimated that this involved about two people months for the design and adaptation to the software and about two hours per day of administration over the 30 day cycle. Commitment to the development time of the e-Sim by staff involved has been accounted for as educational research or teaching development. Some staff experienced increased workloads associated with the marking of assessment items. Because we were concerned that the effectiveness of the e-Sim design and operation was rigorously evaluated additional assessment items were included to provide information about students' learning processes. A fundamental factor influencing the success of this project has been the sharing of access to central course management software licensed to UTS that supported the e-Sim.

Design and Implementation Issues

The e-Sim has encouraged a high level of student interdependence across institutions. Half of the 39 student groups comprised members from different institutions. This was designed to encourage a high level of interaction between students from different institutions and disciplines. While the e-Sim was designed to promote high levels of student interdependence, it has also encouraged a high degree of interdependence between staff. This has been manifested in relation to shared teaching and assessment practices and a sharing of institutional resources that is unusual in the current university context.

Shared Teaching Practices

There were institutional differences in the ways in which the subjects in which the e-Sim was embedded were taught, the amount of staff-student contact time and the extent to which the project member/ subject co-ordinator was the primary student contact for issues related to the e-Sim. To ensure there was a consistent approach to e-Sim issues for both staff and students, a discussion board was established on the e-Sim website to deal with student enquiries. However many student enquiries particularly about group dynamics and strategic advice were handled by staff at the various sites. A better understanding of how teaching was carried out in each of the subjects would have made it easier to support staff needs. We expect that the management of student expectations will be assisted in the future as additional material is added to the website and the student grapevine passes on tacit knowledge about the e-Sim operation and its role in the subjects.

The design of the e-Sim required knowledge and understanding from all of the collaborators about the needs and capabilities of their students. However it also required agreement about how to conceptualise both the Mekong region as well as engineering and development studies in a way that was engaging to the students and likely to lead to the desired learning. This required viewing potential issues to be dealt with in the e-Sim from a much broader (i.e. political, economic, social) perspective than may normally occur when teaching within their individual subjects. It also necessitated considering the e-Sim setting and personae from a simplified, slightly stereotyped framework that would facilitate students' immediate engagement. This contrasts with the more extended and sophisticated understanding that the staff would use in their own work. Students were expected to develop more sophisticated understandings during the e-Sim. In order to design the e-Sim it was critical that project staff explicated these understandings and their belief frameworks, and developed a shared set of understandings about teaching and key learning outcomes. This sharing of teaching practice between the collaborators required considerable effort and constant re-visiting.

Managing groups that comprised students from more that one university added significantly to the administrative load of the e-Sim. The administration of the distribution of group assessment tasks to staff for marking, managing inter-marker variability and then releasing results was performed centrally. This centralised administration system was effective from a design perspective because it alleviated issues associated with different levels of collaborator familiarity with both the software involved and e-Sim management requirements. We now have a better understanding of the resource implications of this approach, the value of each of the assessment items and a more clear understanding of e-Sim management and dynamics among the staff and students.

Shared Assessment Practices

Each of the subject co-ordinators followed different practices with regard to delegation of marking for assessment items in their subject. Consequently, the extent of the workload from the e-Sim and its management had different impacts upon each of the staff involved. Collaborating staff have had to negotiate the following aspects: what constitutes an acceptable level of feedback for students, the amount of time to be allocated for marking each piece of work, whether grades or marks would be provided, and suitable turn around times for the release of grades and feedback. Due to differences in the number of students from each institution, the differences in expected student capabilities and no a-priori understanding of the expectation of markers within each of the subjects, it was decided that a marker from each subject should mark group work where their own students participated.

This also led to sufficient duplicate marking to have a rudimentary quality system. Where the assessment tasks focused on predominantly scientific content the level of inter-marker variability between the disciplines and institutions was generally within 10%. However, where the assessment tasks involved a greater focus on students making explicit their value and belief systems and dealing with incomplete knowledge there was greater variability. Individual assessment items were handled solely by staff from the students' institution and returned at their discretion.

Shared Institutional Resources

The shared use of institutional resources for non-standard teaching purposes required negotiation and care. The Mekong e-Sim relies on specific Information and Communication Technology tools; specifically an electronic course management system (Blackboard). The initial design of the e-Sim which involved students having access to a single email system supported by one of the universities was abandoned due to institutional concerns about how to manage possible misuse of accounts by students not enrolled at that University. The course management system was flexible enough to allow external email accounts, thus overcoming this problem. Other difficulties arose in obtaining an additional email account for management of the email generated by the e-Sim. Temporary accounts to the course management system had to be negotiated for students not enrolled at the university. Access for non-enrolled students to other software used in the e-Sim was negotiated at a personal level.

The teaching calendars of the three participating institutions differed by a week in both the start date for the semester and the timing if the mid-semester break. The length of the e-Sim was shortened as much as practical to allow for this. However, students from one institution who commenced later, perceived they were disadvantaged by this, and students from another institution had an extended break during the debriefing stage of the e-Sim.

Future Issues

The Mekong project has now passed the initiation and implementation phase and is currently undergoing evaluation and revision. The evaluation data will be used to redesign some of the assessment items so that learning outcomes are still met and students' collaborative learning is still supported while reducing the staff and student workload associated with assessment tasks. This is intended to make the e-Sim more sustainable within the existing budgets associated with teaching and learning for the subjects involved in the e-Sim.

Another issue relevant to the sustainability of educational innovations is the stability of the curricula into which the education innovations are embedded. Changes to aspects of the curriculum in any of the subjects where the e-Sim is embedded may impact upon the viability of the e-Sim. Also, maintaining student diversity through developing a stable range of collaborative partners is needed. The most appropriate curriculum vehicle and range of partners for supporting educational innovations are areas that need to be considered when designing these types of projects.

Conclusion

Educational alliances between staff from different institutions can have a number of benefits for both staff and students. The educational activities and products resulting from the alliance can allow students and staff to share knowledge and practices. While there are significant benefits that can accrue from such projects, there are accompanying issues that relate to initiating and implementing collaborative, cross institutional projects. In this case, issues related to the negotiation of shared assessment practices, teaching and learning practices and institutional resources arose. To help manage staff expectations when entering into these types of 'grassroots' alliances it is necessary to understand some of the issues that may arise during the process and how these can be related to the design of any educational product produced.

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THE WEAKEST LINK: IS WEB-BASED LEARNING CAPABLE OF SUPPORTING PROBLEM-SOLVING AND METACOGNITION?

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Abstract

In the context of higher education, the development of students' problem-solving skills continues to be an area of ongoing research. Effective teaching of problem-solving requires the adoption of process-based approaches that reveal to students the ways that experts solve problems, and the coaching of students in higher order and metacognitive skills. It is suggested that online environments and computer resources can scaffold the acquisition of metacognitive skills and efficient problem-solving. However, many current online resources do not go beyond the provision of heuristics and strategies that can be applied to well-structured problems. This study focuses on the need to link metacognitive and problem-solving support by harnessing technology-based affordances that support process skills, and the anchoring of problem-solving strategies with collaborative social discourse and models of effective problem-solving that prompt reflection on performance.

Keywords

problem-solving, metacognition, scaffolding, online

Problem-solving Skills as Central to Learning

In tertiary education, there is an urgent need for professionals who can solve real problems, anticipate and predict problems and find realistic solutions. To meet this need effectively tertiary educators must now reexamine methods of teaching problem-solving. Taconis, Ferguson-Hessler, and Broekkamp (2001) have recently analysed articles appearing in international journals between 1985 and 1995 on the effectiveness of teaching strategies for science problem-solving. Very briefly, this analysis showed that in student performance and achievement, providing strategy training and practice in problem-solving turned out to have little effect, whereas effective teaching of problem-solving gives attention to contextualised strategies related to domain knowledge. The learning conditions recognised by Taconis et al. (2001) as significant for building problem-solving skills were those which provide learners with guidelines and criteria they can use in judging their own problem-solving processes and products. These conclusions are congruent with earlier research carried out by Mayer (1988) and Lajoie (1993), indicating the need for the integration of metacognitive training and support for problem-solving.

The Learning Paradox

Jonassen (1997) argues that ill-structured, real world problems must become the basis for improving learning, and that effective pedagogy should include the provision of support for learning problem-solving processes. Over the past decade much attention has been paid to the diverse applications of technology that support active student centered learning, but much less attention has been given to the development of problem-solving skills that are the foundations for effective higher-order thinking. A number of contemporary designs of learning environments require student self-direction and high-level metacognitive control. Exploratory and open-ended learning environments enable students to generate knowledge and engage in critical thinking. Similarly, project-based approaches assume that students are able to generate questions and produce a final product that represents knowledge integration. Many students, however, lack essential metacognitive skills and a repertoire of learning strategies to enable them to maximise their learning in innovative learning environments (Hannafin & Land, 1997). Table 1 shows how a range of contemporary learning designs assume metacognitive knowledge.

Example	**Learning scenarios**	**Metacognitive skill needed**
Anchored instruction	Narratives, stories, real life anchors	Capacity to define problems and abstract from case
Open ended learning environment	Multiple scenarios and viewpoints	Self-direction and self-management
Project based learning	Collaborative, task based learning environments	Management of information, self and others
Problem based learning	Presentation of cases and events that present potential problems	Capacity to identify the problem and select resources to solve it

Table 1: Metacognitive requirements of contemporary student–centered learning environments

These environments, though learner-centered and constructivist, assume that students are goal-driven and self-directed. Other research has shown that the processing demands of these environments are problematic and need to be investigated. One of the issues of most concern is that of the learning paradox noted by Schank and Cleave (1995): *"how can students learn by doing what they do, when they do not know how to do what they have to do to learn?"*. Stated quite simply, project and problem-based learning assume that students can access and apply knowledge and metacognitive strategies and engage in self-regulated learning. It is well established that in order to learn effectively, a repertoire of learning strategies and the capacity to manage one's own learning are fundamental (Boekaerts, 2000; De Corte, Verschaffel, & Op'Teynde, 2000). It is this range of skills that we refer to as metacognition.

The Role of Metacognition in Learning and Problem-Solving

Success in problem-solving skills is linked to metacognitive knowledge. Research on problem-solving expertise shows that it is not sufficient to learn procedures and problem-solving heuristics such as defining the problem, planning a solving, testing and checking a solution. It is not enough to know what to do, but also when to apply such strategies. This is *metaskill*, such as self-monitoring and orienting oneself, planning how to proceed, and self-evaluating one's performance. Metacognition is a learner's knowledge about strategies and cognition and the ability to control and monitor those processes (Metcalfe & Shimamura, 1994). Four categories of metacognitive knowledge are recognised as important in problem-solving (White, 1999). These are as follows:

- **Self-knowledge:** Self-knowledge entails the individual's capacity to recognise their strengths and weaknesses and to evaluate themselves.
- **Task-knowledge**: This involves understanding the demands of tasks and what they require.
- **Strategic knowledge**: This refers to the knowledge of usefulness of strategies available for achieving learning goals.
- **Knowledge of plans and goals:** This refers to learner's capacity to set and maintain goals and to record what they intend to do through their learning.

Each of these components requires self-knowledge and are best supported in social settings for learning.

Critique of Current Online Approaches to Supporting Metacognition

As part of our research into problem-solving online, we wanted to ascertain whether there were online resources dedicated to supporting problem-solving, and what form of support was offered. Around 300 URL's relating to problem-solving and metacognition were assessed. Of the total number of sites, only a small number were of direct assistance for students wishing to improve their problem-solving skills. Some comments on a few of these sites, which typify the resources available, are given in Table 2.

The A thru E Approach to Problem-solving http://www.ouc.bc.ca/chem/probsol/ps_A-E.html This is probably one of the best known and widely referred to sites on the Internet for problem-solving in science. It contains around 10 pages of information to help students develop the use of a systematic approach to problem-solving. It does not give actual problems and discuss their solutions, but only outlines the general heuristic, which can be applied to chemistry problems (or other problems) in general.
General Chemistry at Purdue Uni http://chemed.chem.purdue.edu/genchem/probsolv/index.html Shows a solution strategy for several simple chemistry exercises. Students can look at each step of the solution at a time. The examples are straightforward exercises in first year general chemistry, not really problems.
21st Century Problem-solving Howard C McAllister http://www2.hawaii.edu/suremath/home.html A site for problem-solving in algebra, physics and chemistry from high school level up. This site does give worked solutions to example problems using the heuristic developed by McAllister of - Request, Response, Result. As such it does explicitly discuss the processes of problem-solving, however the limitation is that the problems are really well structured as opposed to ill-structured
CheMentor http://www.liv.ac.uk/ctichem/20chment.html CheMentor is an example of interactive tutorial software giving students practice at problem-solving. The educational rationale behind CheMentor is the placing of responsibility for learning with the student. A set of modules have been developed which are highly interactive though there is a certain degree of repetitiveness in terms of doing the same type of problem time and time again.
The McMaster Problem-solving Program Donald R. Woods http://chemeng.mcmaster.ca/mps/ The MPS program is a series of four, required, workshop-style courses to develop process skills and to use small group, self-directed PBL in tutorless groups. The target skills being developed include self-confidence, problem-solving, interpersonal and group, self-assessment, change management and lifetime learning. The total time for the whole course if all units are taken is around 150 hours!

Table 2: Analysis of online resources providing support for problem-solving

The sites listed above concentrate purely on task-knowledge and, in some cases, strategic knowledge. At best they provide lists of tips and strategies, which according to the research on metacognition and problem-solving are insufficient as they make little progress towards developing the four categories of metacognitive knowledge identified by White (1999) - self knowledge, task knowledge, strategic knowledge and knowledge of plans and goals. In addition, recent metacognitive research emphasizes the need to balance cognitive and social competence and the need to create social, interactive and reflective environments with a holistic approach to supporting metacognition (Lewis, 1998).

Supporting Problem-Solving and Metacognition Online

A major challenge for educational technologists is to go beyond information access and provide tools and scaffolds for complex problem-solving and metacognition. Already, there is evidence that research on metacognitive skills development and technology based scaffolding is converging (White, Shimoda & Frederiksen, 2000). New advances have in common the need to present students with complex ill-defined problems, strategy training and a social environment that fosters reflection and self-knowledge. For instance, the essential design ingredients in supporting metacognition proposed by Lin, Hmelo, Kinzer and Secules (1999) in technology-supported learning environments are *as follows:*

- Provide multiple models of real performance;
- Prompt learners to investigate their own thinking while problem-solving;
- Provide visual displays of the processes students have utilised as they solve problems

- Provide students with multiple perspectives on process through reflective social dialogue;
- Scaffold adoption of expert strategies by providing examples and a context for application;
- Develop a strong sense of self as learner and problem solver by enabling goal-setting;
- Create a social setting online with support for interaction and communication.

These features have been embedded in the online tool metAHEAD, developed at UNE to support the metacognitive skills of first year science students (Hollingworth & McLoughlin, 2001). Another example is the SCI-WISE system devised by White et al. (2000) which provides tools to foster meta-level expertise in scientific problem-solving. Similarly, Laffey, Tupper and Mussen (1998) have utilised a bulletin board where students post progress reports and seek assistance on aspects of learning that are problematic. In summary, these designs provide examples of how to make efficient use of the visual, social, reflective and exploratory resources of the Web to scaffold the metacognitive aspects of problem-solving.

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QUALITY IN ONLINE DELIVERY: WHAT DOES IT MEAN FOR ASSESSMENT IN E-LEARNING ENVIRONMENTS?

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Abstract

While a great deal has been written on the advantages and benefits of online teaching, and research continues to proliferate, many practitioners are seeking guidelines that can be applied to the design of assessment in online environments. The last decade has seen the convergence of traditional distance education with on-campus modes of delivery and work-based training signalling new models of flexible delivery. In addition, demand driven education accentuates the learner's role and needs while the teacher has become a manager, mediator and motivator of student learning. Issues raised by national and international bodies and quality assurance agencies now seem to be addressing the same questions. How can a teaching and learning process that differs so markedly from what has been practiced for hundreds of years maintain and support quality? Who will be the guardians of quality and the innovators of learning and assessment design?

This paper addresses current definitions of quality in online assessment and examines emerging expectations of what constitutes appropriate online assessment. A case study is presented of a Web-based assessment framework that is both interactive and product-oriented and involves learners in making contributions to course resources through learning activities. It is proposed that an interactive-participatory model of assessment utilises the communicative features of technology while affording a motivating and authentic assessment experience.

Keywords
assessment, e-learning, higher education, quality

Introduction: The Quality Debate

A number of reports and documents provide design guidelines and benchmarks for distance education environments. For example the Institute for Higher Education Policy (National Education Association, 2000) provides 24 benchmarks for course design, delivery and learning outcomes. In their report no specific recommendations are made except to suggest that intended learning outcomes are regularly reviewed to ensure clarity, consistency and appropriateness. Penn State University in association with Lincoln University (Innovations in Distance Education, 1999) have taken this a step further and promote that "where possible provide assessment and measurement techniques and options that capitalise on the unique characteristics and situations of the distance learner". Recommendations on assessment processes are as follows:

- Enable students to self-monitor progress;
- Give regular feedback to students;
- Support peer learning and assessment;
- Design self-assessment practices.

These recommendations are in line with those of Berge, Collins and Dougherty (2000) who also suggest, with respect to online learning, that "wisdom might be served by using alternative forms of assessment of student understanding". One example they cite is the use a series of sequential exercises building upon one another throughout a semester, so that issues of security are less of a problem. However, in all the reports cited here, there is a dearth of pedagogical guidelines for practitioners. The Quality Assurance Agency for Higher Education (1999) acknowledges that there are differences in the way assessment is conducted on campus that may not be appropriate for students studying in the off-campus mode, who have little contact with academic staff. In another study Warren and Rada (1999) address the issue of quality learning via computer-mediated communication. They define quality learning as going beyond the acquisition of facts to achieving a cognitive outcome, and fostering higher order thinking at the level of synthesis and evaluation of concepts.

Is Quality a Matter of Design?

Others argue that no single design or perspective is adequate for the design of technology-enhanced learning environments (Sfaard, 1998). The same message about multiplicity comes from Spector (2000) who notes "technology has yet to make significant improvements in the quality of education by any reasonable measure" (p. 243). Spector continues to argue that most failures can in fact be attributed to the belief that there is one best approach, one perfect theory or one final solution. The McKinnon Report (McKinnon, Walker & Davis, 2000) provides a student satisfaction benchmark that monitors student ratings of their learning experience and overall satisfaction with assessment based on the Course Experience Questionnaire (CEQ) administered when students have graduated. Data coming from the CEQ only measure satisfaction with existing assessment arrangements, but do not provide any indicators of quality beyond student satisfaction. Teachers and designers need a principled basis for designing new forms of assessment, closely aligned with instructional goals and utilising the interactive features of online technology (American Psychological Association, 1993). If we acknowledge that assessment drives student learning, it is likely that it will remain at the centre of the curriculum design process, and will be central in the student learning experience (Ramsden, 1992; Biggs, 1999).

We may conclude from this overview of the quality assurance debate that the notion of quality defined in terms of student satisfaction with assessment processes is important, yet few guidelines have been provided by academics on what practices to adopt when designing educative, authentic or valid assessment processes that are suited to distance education and online environments. Most often, quality issues are tied up with implementation, infrastructure and delivery of services to students and they provide a big picture view of the systems that need to be in place to enable assessment to be managed at an institutional level. Collis and Moonen (2001) propose a four-dimensional model that incorporates technology adoption, implementation, pedagogy and institutional planning that combine to influence the quality of teaching and learning that occurs.

Are there Opportunities for Improved Assessment Practices on the Web?

Information and communication technologies (ICT) have the capacity to support a wide range of learning goals and are now integrated into teaching approaches of many higher educational institutions. Laurillard (1993) suggests that computer-based learning has a major role in promoting:

- self-directed learning and increased student autonomy;
- flexibility and diversity in assessment;
- increased information literacy, ensuring that graduate skills are in tune with those of employers; and
- increased productivity and efficiency in higher education.

Similarly, Alexander and McKenzie (1998) reviewed 104 projects relating to innovative technology adoption and found that students had improved attitudes to learning, improved access, and improved opportunities to interact and develop information literacy. However, opportunities for learning do not always translate into learning outcomes. Alexander and McKenzie (1999) also reviewed student perceptions of technology and the value of ICT for learning. The major findings were as follows:

- Student perceptions of technology are a major influence on their attitude and approach to learning. Will they earn extra marks for using technology? Will it be counted in their grades? In designing a course, this might mean evaluating student contributions to a bulletin board as part of the formal assessment process.
- Often students' experiences of working in groups is one of frustration, despite claims that technology is bringing about peer relationships and better communication.
- Students' prior experience of teaching and learning influences their acceptance of new learning approaches, whether these are with or without technology.
- Students do not feel that quantifiable learning gains are always achieved from technology use.

Given these results and the additional finding that ICT adoption did not bring about pedagogical change in the Alexander and McKenzie (1998) report, Collis and Moonen (2001) conclude that while learning gains cannot be proved, they still remain optimistic about technology integration. They contend "what can be claimed at a general level is that students experience new forms of learning, that instructors are making new types of contacts with their students and that new resources and types of learning activities are occurring". Other researchers would say that what determines the educational value of ICT is how it is used in practice (Schacter, 1999). Whether these new learning activities have arisen out of new curriculum approaches and can lead to innovative assessment practices is a matter of importance to online educators and instructional designers.

Web-based Learning: Does it Mean New Pedagogy or Just Repackaging?

The shift to student self-direction and autonomy means that students need to take more responsibility for their own learning, but many need assistance in achieving this skill. Shaffer and Resnick (1999) maintain that technology can be used to create authentic contexts for learning, and provide resources that give students opportunities in a number of areas:

- connectivity: to connect to the world outside the classroom, to research topics that would otherwise be inaccessible, to access experts and to engage in conversations with peers;
- authenticity: to demonstrate performance in authentic tasks and communicate events;
- epistemological pluralism: to express and represent ideas in many different ways.

Applied to assessment, representational pluralism enabled by computer technology expands the range of channels available to students to demonstrate understanding (Gardner, 1993; Greeno & Hall, 1997). For example, instead of using narrowly defined learning outcomes tested by examinations, technology offers a total environment where real life skills, such as written and verbal communication, collaboration and team work can be assessed by giving learners multiple channels of expression, such as visualisation and multimedia. Thus, information technologies can change the quality of the learning experience, and can be used to create authentic environments for assessment.

Terms used to describe the impact of ICT in higher education are many: flexibility, learner-centeredness, Rich Environments for Active Learning (REALs), anchored environments, mediated learning, cooperative learning and global classrooms (see Abbey (2000) for a complete overview). Yet how many of these are *new designs* as opposed to just *new terms* for learning? Russell (1999) claims that despite all these innovations, no significant differences have emerged for learning outcomes in technology supported environments. While it is claimed that the Web does offer new opportunities for learning activities, assessment practices must be reframed and reconsidered as part of a holistic approach to curriculum design and pedagogy.

Collis and Moonen (2001) use the term *pedagogical re-engineering* to describe the change in online pedagogy from one that is teacher centred to one that is focussed on learner activity. Pedagogical re-engineering is based on the premise that courses are built up of components or units of instruction that are bound together in sequences or combinations. By introducing technology and Web-based learning, these components can be changed and made more flexible and student-centred, thus leading to course enhancement through the adoption of learner-centred pedagogies and new forms of assessment.

Does Web-based Learning also Mean New Conceptions of Curriculum?

A key element in pedagogical re-engineering is the use and application of media to teaching and learning scenarios where students are active participants and contribute actively by generating knowledge. By changing roles and by enabling students to make contributions towards learning resources, assessment also becomes more learner-centred and performance-based. For example, in some activities students can post new URLs to the course site so that others can share and critically evaluate them, and these resources become part of the learning activity. Similarly, the move towards peer assessment is an indicator of pedagogical extension via the Web, as online communication tools, shared workspaces and asynchronous dialogue make networked learning and assessment feasible. This participatory/contributions-oriented approach to learning can be summarised as follows:

- Assessment activities recognise students as contributors;
- Assessment activities involve opportunities for students to communicate, contribute to, and participate in an online community;
- Assessment activity reflects the status of students as contributors to course content, and creators of new knowledge products.

It is certainly the case that online technologies and Web-based learning have led to a reconceptualisation of learning, pedagogy and assessment. This is reflected in the various theories of learning, which emphasise learning activity, participation in communities of learning, engagement theory and the contributions-oriented student model proposed by Collis and Moonen (2001). Table 1 summarises the notion of the active, participatory student and its implications for pedagogy.

	Contributing student model (Collis & Moonen, 2001)	**Participation oriented learning (Sfaard, 1998)**	**Engagement Theory (Kearsley & Schneiderman, 1998)**	**Constructive alignment model (Biggs, 1999)**
Definitions of learning	Learners contribute to the course via Web-based tools	Participation, member of a community	Meaningful activity with others and interaction through worthwhile tasks	Emphasis on student activity
Learning outcomes	Product-oriented, focussed on peer learning, sharing and collaboration	Belonging, participating, communication, lifelong learning	Higher order thinking, team work and generic capabilities that include information literacy and global perspective	A well structured knowledge base, interaction with others
Key activities	Preparation before class, activities during class, review and self assessment after class	Apprenticeship, communication, participation	Team work, interactive learning, peer learning	Teacher-directed, peer-directed and self-directed activity
Curriculum process	Reusable learning objects and resources are created by students	Negotiated; student as participant	Needs based, project-oriented, authentic	Align teaching methods, assessment and student activity
Teacher role	Design activities for maximum student participation	Facilitator, mentor	Coaching of project based learning	Maximise structure, offer scaffolding, foster self-direction

Table 1: Summary of key features - Student as Participant (based on Collis and Moonen, 2001))

The 'student as participant approach' is enabled by Web-based technology, which gives students access to learning resources, communication tools, databases and asynchronous networks. These models of learning accentuate the movement away from transmission-oriented approaches and towards active learning where the student generates products and resources that can be re-used and shared with others. This approach can be applied to assessment, so it becomes less teacher-dominated and more flexible, with more autonomy and responsibly given to the student. For example, peer and self-assessment activities offer scope for learners to assume the roles of critical participant and contributor, while creating online portfolios can allow students the scope to share ideas and to engage in peer review.

Alternative Assessment Using Technology

In recognition of the limitations of traditional university assessment, there is a new wave of pedagogy advocating 'alternative assessment' in which assessment is integrated with learning processes and real-life performance as opposed to display of inert knowledge (Wiggins, 1998). This form of authentic assessment is solidly based on constructivism, which recognises the learner as the chief architect of knowledge building.

In constructivist learning environments there is social interaction, communication, exchange of views, collaboration and support for learners to take more responsibility for the learning process through learner-centred tasks (McLoughlin & Oliver, 1998; Collis, 1998). Salient features of constructivist learning environments include an emphasis on the following aspects:

- *authenticity:* learning is located in actual contexts and linked to real tasks;
- *group work:* social interaction and feedback are instrumental in communication and higher order thinking processes;
- *learner control*: learners are active in defining and negotiating learning tasks; and
- *scaffolding learning*: learners are supported as they progress from novice learners to self-regulated experts.

Authentic or performance assessment can be effectively used in constructivist learning environments as it enables both process and product knowledge to be assessed, supported by communication channels for group work, reflection, higher-order thinking and self-directed learning (Scardamalia & Bereiter, 1992; Birenbaum, 1999; Reeves, 2000).

The use of the Web to support assessment offers greater adaptability and flexibility than traditional or objective assessment (e.g., based on discrete tests and multiple choice quiz items) as it enables the collection and storage of continuous data, and easily created micro-environments where learners solve real life problems. It can be argued that the move towards authentic assessment paradigms has been accelerated by technology with its capacity to cope with a broad array of activities, tasks and forums for collaboration, dialogue and student-centred learning. For instance, Kendle and Northhcote (2000) suggest a combination of qualitative and quantitative assessment tasks that use multiple modes of showcasing student achievement through portfolios, multimedia projects, skills demonstrations and teamwork. Table 2 contrasts some features of authentic assessment with standard objective assessment, and provides examples of how Web-based environments offer possibilities for authentic assessment tasks.

A further important contribution made by technology to authentic and performance-based assessment is the capacity to support learning processes such as communication, group work and collaborative problem solving. The following section present a case study demonstrating multiple forms of assessing student learning online, while maintaining a focus on learning processes and professional skills rather than content-based outcomes.

Objective assessment	Authentic assessment	Indicators of authenticity	Web-based support
Require correct responses only	Require quality product and/or performance, and justification.	Assess whether the student can explain, apply, self-adjust, or justify answers, not just the correctness of answers using facts and algorithms.	Allows students to articulate viewpoints in text-based conversation that can be archived as a learning resource.
Must be unknown in advance to ensure validity	Are known as much as possible in advance; involve excelling at predictable demanding and core tasks; are not gotcha! experiences.	The tasks, criteria, and standards by which work will be judged are predictable or known like a project proposal for a client, etc.	Web-based teaching allows access to multiple sources of information about the task, while allowing learners to explore alternatives.
Are disconnected from a realistic context and realistic constraints	Require real-world use of knowledge: the student must do history, science, etc. in realistic simulations or actual use.	The task is a challenge and a set of constraints that are authentic likely to be encountered by the professional.(Know-how, not plugging in, is required.)	The task is a challenge and can extend the confines of the classroom to involve complex, ill-defined tasks and collaboration.
Contain isolated items requiring use or recognition of known answers or skills	Are integrated challenges in which knowledge and judgment must be innovatively used to fashion a quality product or performance.	The task is multifaceted and non-routine, even if there is a right answer. It thus requires problem clarification, trial and error, adjustments, adapting to the case or facts at hand, etc.	Web provides access to information, databases and course notes. Learners have control.
Are simplified so as to be easy to score reliably	Involve complex and non-arbitrary tasks, criteria, and standards.	The task involves the important aspects of performance and/or core challenges of the field of study	Web-based learning provides multiple vehicles for showcasing student achievement, including portfolios and skills demonstrations.
Are one shot	Are iterative: contain recurring essential tasks, and learning processes.	The work is designed to reveal whether the student has achieved real versus surface mastery, or understanding versus mere familiarity, over time.	Web-based teaching enables gathering of continuous process data on student achievement.

Table 2: Elements of authentic assessment utilising the Web

Context of the Study

Final year students enrolled in the Interactive Multimedia course at Edith Cowan University are required to develop skills and expertise in managing the design and development of client web sites. The unit IMM 3228/4228 – "Project Management Methodologies", uses teams of four or five students to utilise their specialist skills to build an electronic portfolio. Team roles include programmers, graphic designers and project managers. There were 82 students completing this unit, which was delivered through a custom built web site to enable both internal and external students access to resources, and also to enhance the quality of the learning environment. Students negotiate a project topic with their tutor, which is aimed at meeting a "real need" for an industry or university client. Requirements include:

- significant contribution and participation to the development of a team-based multimedia project;
- a critical analysis of the project management of a team-based multimedia project;
- formative evaluation of the multimedia product; and
- an analysis of the intended implementation methodologies for that product; and, where relevant, a prediction of the organisational and cultural changes likely to result from the implementation of that product.

The aim was to have students experience project management issues that occur when dealing with "real" clients in "real" projects.

The Learning Environment and Task Design

The development of project management skills that are transferable to real world contexts means that learners have to assume more responsibility for their own learning, but many need assistance in achieving these skills. In this tertiary setting, the development of professional skills was linked to the creation of a project-based learning environment. Group-based project work was chosen for its relevance and congruence to the learning outcomes that were sought. Project work is advocated for its capacity to support professional expertise and vocational skills and has been successful as an instructional strategy in may contexts (Collis, 1998; Klemm & Snell, 1996; English & Yazdani, 1999). Learner activities were undertaken in groups and teams.

This style of problem-based learning involves a number of activities and tasks that appear to provide robust support for the development of a number of key skills. As shown in Figure 1, the activities that were designed included:

- To help gain commitment, students were required to complete an online "student contract" at the beginning of the semester, signed by themselves, their team members', and the tutor. The contract outlined students' responsibilities needed for developing the teams' web site and weekly tasks.
- Teams were required to complete problem-solving tasks each week, which required students to seek information from a variety of sources that reflected state-of-the-art knowledge about project management. Students used information provided through the online application, as well as the Web and had to select resources that were relevant to the task from the many that were available.
- Having solved the weekly problem, teams were required to apply inter-team assessment. They were required to assess other teams' solutions and defend the assigned marks with comments based on valid criteria. If students were unhappy with the results, they could make comments on the bulletin boards, asking for clarification from other teams or tutors.
- Each week students were required to perform intra-team assessment (Figure 2). Students assessed their own progress as well as their peers, giving confidential information to the tutors through the online system. Tutors used this information to help make decisions about transferring marks in "tutor led peer assessment sessions".

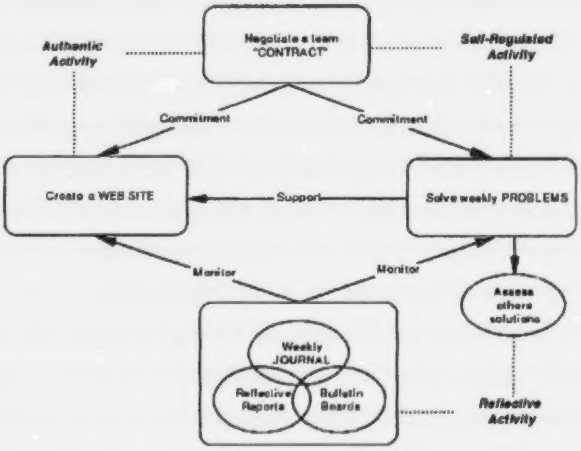
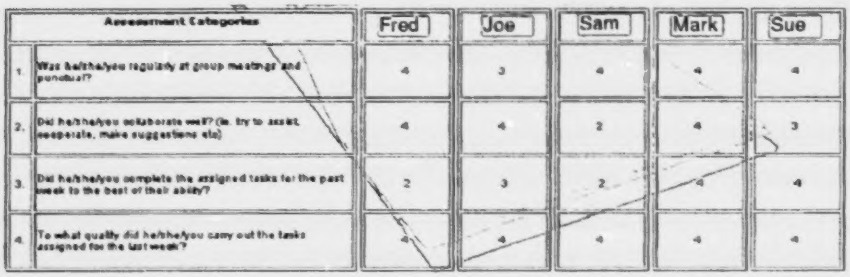


Figure 1: The learning environment

- Personal reflection on task and process - each student maintained a reflective journal in which personal views of progress of skills and competencies were recorded. Students considered the skills they applied, the skills that needed to develop and tasks that needed to be completed, as agreed to within the team. This provided a strong framework for the development of personal and process knowledge.

- In order to build the web site (and create solutions for the weekly problems), a high level of collaboration was required. The teams were required to share the workload, undertake separate tasks and maintain tight deadlines and schedules from one week to the next. Such activities demanded the students consider requirements of others, be adaptive, responsible and flexible.



	Assessment Categories	Fred	Joe	Sam	Mark	Sue
1.	Was he/she/you regularly at group meetings and punctual?	4	3	4	4	4
2.	Did he/she/you collaborate well? (ie. try to assist, cooperate, make suggestions etc)	4	4	2	4	3
3.	Did he/she/you complete the assigned tasks for the past week to the best of their ability?	2	3	2	4	4
4.	To what quality did he/she/you carry out the tasks assigned for the last week?	4	4	4	4	4

Figure 2: Sample journal entry showing self and peer assessment

Students were given both print and online resources to help develop solutions for the weekly problems. Participants could view the solution, peer/tutor feedback and overall marks online.

Summary: Implementing Interactive/Product-oriented Assessment

In this article we have depicted the core elements of an approach to assessment that provides opportunities for student engagement, participation and contribution to course content. The features of this form of assessment include performance assessment that requires students to create a product, engage in teamwork and elements of self and peer assessment. In designing the assessment consideration was give to the notions of pedagogical re-engineering and the creation of a workable, pragmatic approach within which to implement a participatory approach to learning and assessment. Laurillard (1996) combines the notion of media affordances and pedagogic re-engineering and has applied this to Open University courses. The notion of affordances examines each of the media and how they can provide a different form of interaction. Four modes are identified: attending, practicing, discussing and articulating. In designing the assessment task our goal was to decrease attending and increase each of the other forms of interaction. This meant applying the notion of student as participant, and as active contributor to the learning and assessment processes of the unit. Table 3 shows how student activity and assessment processes were integrated into participatory forms of assessment.

Modes of student interaction	Student contributions to the unit	Interactive assessment activities
¥Attending	Design and develop team web site	Intra-team peer review
• Practicing	Post solutions to weekly problems	Intra-team peer review
• Discussing	Post weekly journals	Inter-team peer review and commitment to tasks
¥Articulating	Develop electronic portfolio	Critique and peer feedback on portfolios
	Develop a team contract outlining team responsibilities	Negotiate roles and commitments for each team member

Table 3: Interactive-participatory assessment

At the end of the semester, the unit was evaluated with a CEQ questionnaire, as well as a focus group interview session. The results were very positive. Student comments strongly favoured the authentic nature of the unit, and were highly motivated by the "relevance" they could see in developing these skills for industry. Comments included:

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- *"I wanted to have a product that would show industry/employers that I had skills."*
- *"I found it necessary to track my time carefully and set priorities, otherwise I would let the rest of the team down."*
- *"I enjoyed filling out the weekly journals. Not only did it let me consider how the team was going, but it was great to lay out all the tasks that needed doing."*
- *"This was the first unit that really got us doing teamwork. Other units just do a bit here and there, but this was full on teamwork, and it was working toward getting skills and a product that would promote us to the industry."*
- *"It was great to be able to see all the others teams work, and think about how it compared to ours."*

The response from the industry clients was also very positive, indicating the relevance of the skills demonstrated to industry needs.

Future Directions for Quality in Online Assessment

Judging by present trend, there is no doubt that Web-based learning and training will continue to expand, with the growth in markets, the trend towards lifelong learning and the need for universities to offer flexible, on demand educational services. In this scenario, it is likely that quality assurance processes for online assessment will intensify, with benchmarking procedures developed to compare learner performance to exit level or industry standards. Key questions that tertiary providers may have to respond to are: *How is this graduate performing in comparison with a professional in the field? What are the minimum exit standards for this student entering the profession?*

Another issue is that benchmarks must be transparent to the learners, and must represent authentic behaviour and expectations, rather than abstract decontextualised knowledge. These immediate trends are emerging in higher education and will impact on assessment design. Other innovations mentioned in this paper relate to a re-conceptualisation of curriculum as participatory, with students contributing resources rather than content being prescribed. This emphasis on knowledge building and participation has already brought about an increased focus on authentic assessment, which better reflects real world performance. On the horizon looms the question: If authentic, quality assessment and its demonstration depend upon performing in a genuine, real life situation what are the actual limits of online assessment? Will technology be able to meet the future challenge of the quality assurance agenda?

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ASSESSING STUDENTS' SELF-REGULATORY SKILLS

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Abstract

Students' ability to use self-regulatory learning skills is becoming increasingly important with the advent of web-based learning. Online courses delivered through the Web require students to take more ownership over how and when learning takes place, rather than tutors and lecturers making these decisions. This comes at a time when higher education institutions have increasing pressure to develop students' life long learning and generic skills from both employers and funding authorities.

In this paper we will investigate a conceptual framework for identifying students' self-regulatory skills and consider a testing instrument to identify students strengths and weaknesses. The instrument can be administered online, from which a full analysis of the results is immediately returned to both student and tutor. From the 77 items used, a subset of these are selected and mapped to the six dimensions defined in the conceptual framework.

The conceptual framework and associated questions related to each of the defined dimensions, provides a quick and convenient tool for assessing students' self-regulatory skills. This mapping can help educators provide assessment and timely feedback to students at a time when there is a pronounced emphasis in higher education to provide skills and competencies that can be transferred to the workplace.

Keywords

self-regulation, generic skills, higher education

Introduction

Over the past few years there has been increasing pressure on higher education institutions from employers and funding authorities to promote the development of students' generic skills. From the many reports written about these, it is often difficult to obtain a consistent set of required generic skills across different institutions/authors. There is however, a consistent demand for graduating students to have life long learning skills that enable learners to continually upgrade their skills and knowledge through their own self-motivation and learning skills (Australian National Training Authority, 1998; Bennett, Dunne & Carre, 1999; Candy, Crebert & O'Leary, 1994; Dearing, 1997; Mayer, 1992).

An important aspect for achieving this goal is to help students take more responsibility for managing their own learning by helping them become more strategic learners. Biggs (1999) argues that there are certain limits to what certain students can achieve, and these are beyond the teacher's control, however good teaching practice can narrow this gap "good teaching is getting most students to use higher order cognitive level processes that the more academic students use spontaneously" (Biggs, 1999, p. 4). The challenge for educators then is to find teaching and learning methods that bridge this gap, which include valid assessment and feedback instruments to help students locate their strengths and deficiencies. With the pressure of employers, funding authorities and now the advent of online learning for a greater proportion of students, tertiary educators must now determine how best to foster self-regulated learning amongst students. Loomis (2000) contends that it is hardly surprising that there is a high dropout rate for students with poor study skills when they venture onto online courses. Brooks (1997) goes so far as to claim that students "who are poor at self-regulation easily can be slaughtered in www-based courses" (p. 135). While it cannot be denied that the Web has the capability to be an efficient and flexible environment for users to meet their own learning goals, a necessary first step would appear to be the identification of students who may potentially be at risk of failure in such environments through the lack of self-regulatory skills.

This paper will examine the nature of self-regulation, and the enabling attributes that underpin this ability. In order to assess students' self regulatory skills, a subset of items from an existing validated instrument is proposed. LASSI, a tool for assessing students study habits will be analysed in terms of its potential to assess underpinning attributes for self-regulation.

A Definition of Self-regulation

Self-regulation is somewhat easier to define than understand. It has been described as 'the process whereby students activate and sustain cognitions, behaviours, and affects, which are systematically oriented toward attainment of their goals' (Schunk & Zimmerman, 1994, cited by Boekaerts, 1997, p. 171). This definition is reinforced by Brooks (1997) who argues that it is active and goal directed, resulting from self control of behaviour motivation and cognition. This emphasis on multiple constructs places self-regulated learning at the junction of several fields of research (Boekaerts, 1997). It emphasises students' reliance on their own internal resources to govern their learning, but these resources are not easy to delineate. Self-regulated behaviour is an end process, dependent upon the affects and cognitions that precede it. These are to a certain extent inaccessible, since they are internally constructed and not always explicitly articulated by individuals.

Also, the notion of self-regulation is prone to multiple interpretations based upon educational philosophy. Zimmerman (1989) identifies it in terms of phenomenological, social cognitive, volitional, Vygotskian and cognitive constructivist theories. All of these approaches bring a unique framework to the concept. Behaviourist approaches emphasise self-monitoring, self-instruction and self-reinforcement, while a phenomenological approach defines it in dimensions such as self-worth, planning, and goal setting. Common to most of these however, is an acknowledgment of the interaction of affective and cognitive processes at a level of abstraction. Self-awareness at a cognitive and emotional level would appear to be the key enabling process in the development of self-regulatory strategies.

A Model of Self-regulation

A number of models have been developed to explain the processes that underpin self-regulated learning. Boekaerts (1997) provides a six component model based upon the following notions:

- Content domain
- Cognitive strategies
- Cognitive regulatory strategies
- Metacognitive knowledge and motivational beliefs
- Motivational strategy use
- Motivational regulatory strategies.

These elements are co-dependent and interact with each other in the application and development of goals, strategies and domain-specific knowledge.

Garcia and Pintrich (1994) articulates self-regulation in terms of knowledge and beliefs, strategies used, and outcomes. Each of these is moderated by motivational and cognitive components such as personal beliefs and conceptual knowledge, motivational and cognitive strategies, and quantity and quality of effort. Common to both models is an integration of both affective and cognitive issues:

> Neither motivational nor cognitive models alone can fully describe the various aspects of student academic learning, yet the two types of models are complementary due to the respective strengths and weaknesses of motivational and cognitive models (Garcia & Pintrich, 1994, p. 127)

Figure 1 represents a synthesis of the above frameworks. It accommodates the role of both affective and cognitive aspects of self-regulation, but also acknowledges the effects of external environmental factors upon an individual's ability to regulate their learning. Self-regulation is viewed here as the intersection of self-awareness at both a rational and emotional level. Metacognition and self concept are seen as the primary enabling process in this model, with self-monitoring and motivation as subordinate processes which are involved in the development of cognitive and motivational strategies.

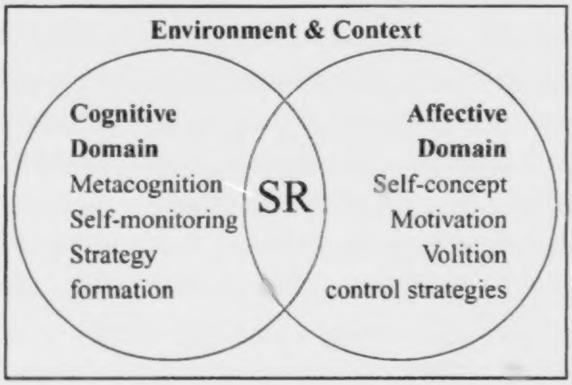

Figure 1: Conceptual framework

LASSI – The Learning and Study Strategies Inventory

Weinstein, Palmer and Schulte (1987) developed the Learning and Study Strategies Inventory (LASSI) over ten years ago and it is currently used by almost 2000 tertiary institutions over the world (online). It was developed as an diagnostic tool to measure how students use learning strategies in academic environments, so they can be strengthened through interventions. "It is designed to gather information about learning and study practices and attitudes based on 77 statements related to learning and studying" (Weinstein, Palmer & Schulte, 1987, p. 2). It provides assessment in ten learning and studying scales as follows:

- Attitude towards studying and motivation for success
- Motivation, diligence, self-discipline, and willingness to work hard
- Use of time management principles for academic tasks
- Anxiety and worry about school performance
- Concentration and attention to academic tasks
- Information processing, acquiring knowledge, and reasoning
- Selecting main ideas and recognizing important information
- Use of support techniques and materials
- Self-testing, reviewing, and preparing for classes
- Test strategies and preparing for tests

These LASSI scales are administered through either paper-based, floppy disk or web-based testing, in which students are generally given both pre- and post-tests to test their progress. In many instances, after the pre-test, students are given advice about how to improve their performance if they scored below the 50th percentile. An example of the type of feedback that can given to students is demonstrated in Table 1 (Haught, Hill, Walls & Nardi, 1998). This feedback can be structured so that it is more directed and customised for all students in order to give them greater scaffolding/ assistance in developing these skills. Depending on what score or percentile was obtained on each of the scales, different levels of assistance could be suggested to encourage self-improvement. Other resources are available to assist tutors in giving students feedback, based on the LASSI scores. Bogue (1993) has published a book based on each of the LASSI learning characteristics and gives suggestions as to what students can do to improve skills in each of these areas.

Scale	Suggestions for students who scored low on this measure
Attitude	Work on higher level goal setting and reassess how school fits into your future
Motivation	Work on goal setting for individual tasks and assignments
Time Management	Learn how to create a schedule and to deal with distractions, competing goals, and procrastination
Anxiety	Learn techniques for coping with anxiety and reducing worry so you can focus on the task and not on anxiety
Concentration	Learn techniques to enhance concentration and set priorities by focusing attention on the task at hand and eliminating interfering thoughts, emotions, feelings, and situations
Information Processing	Learn methods that you can use to help add meaning and organization to what you are trying to learn
Selecting Main Ideas	Learn more about how to identify important information so that you can focus attention and information processing strategies on appropriate material
Study Aids	Learn more about the types of study aids provided in educational materials and how you can create your own aids
Self Testing	Learn more about the importance of self-testing and need to learn specific methods to review school material and to monitor your comprehension
Test Strategies	Learn more about how to prepare for tests, how to create a plan of attack for taking a test, the characteristics of different types of tests and test items, and how to reason through to an answer

Table 1: LASSI subscales-low score suggestions offered to students

As well as using the LASSI instrument to give students direct feedback on these ten scales, other researchers have used LASSI to create latent variables as a basis for their educational research. Olejnik and Nist (1992) created three tacit variables based on the LASSI scales as part of their research. They identified "*Effort*", which was related to activities based on motivation, time management, and concentration; "*Goal Orientated*" activities based on the anxiety, test strategies, and selecting main ideas subscales; and "*Cognitive*" activities based on information processing, study aids, and self-testing subscales.

After students complete the LASSI test (through online administration), they immediately receive feedback about their results. As shown in Figure 2, the results clearly show students their strengths and weaknesses in areas related to strategic learning. Tutors also have access to all of these, which they use to help provide advice and support to students in areas of weakness.

```
     01  05  10  15  20  25  30  35  40  45  50  55  60  65  70  75  80  85  90  95  99
ATT  ---------------------------------------------------------------->
MOT  ------------------------------------------>
TMT  -------------------->
ANX  ---------------->
CON  ---------------------------------------------------->
INP  ------------------------------------------------------------------------->
SMI  ------------------------------------------------------------>
STA  ------------------------------------>
SFT  -------------------------------------------------------------------->
TST  ------------------------------------------------>
     01  05  10  15  20  25  30  35  40  45  50  55  60  65  70  75  80  85  90  95  99
```

Figure 2: Sample LASSI feedback

LASSI as a Tool for Assessing Self-regulation

The LASSI subscales listed in Table 1 offer some insight into commonalities between the inventory and the model for self-regulation proposed. Motivation, for example, is an element that is integral to both. This does not mean, however, that the two can be seen as synonymous. The use of study aids, for example, is essential to self-regulated learning, but it does not mean that those students who use aids are necessarily capable of regulating their own learning, since these may simply be received aids and not conscious process of strategy formation. In contrast, students' creating their own aids is a more likely indication of the metacognitive and self-monitoring processes that underpin self-regulatory processes.

Therefore care needs to be taken to select items that are integral to the concept of self-regulation and remove those that are extraneous. What follows is an analysis of inventory items, identifying those which best appear to represent self-regulatory processes. While an element of subjectivity must be acknowledged in this process, a rationale is provided for why items have been classified in particular ways, and why others have been discarded entirely.

Analysis of LASSI Items

Items that assess Metacognition.

- I try to see how what I am studying would apply to my everyday living
- I try to find relationships between what I am learning and what I already know
- I try to relate what I am studying to my own experiences
- I try to interrelate themes in what I am studying

Metacognition can be defined as "knowledge and beliefs about thinking and the factors affecting thinking" which regulate "the articulation of strategy and knowledge" (Pressley, Van Etten, Yokoi, Freebern & Van Meter, 1998, p. 347). As such it is a necessary precursor to self-regulation. Flavell (cited in Boekaerts, 1987) identifies three types of metacognition: knowledge of self, knowledge about various cognitive tasks and strategy knowledge. All of the items above identify aspects of cognitive self awareness, whether based around the ability to abstract from specific to general situations or to articulate new knowledge in terms of concepts that are already understood.

Items that assess Self Concept

- I worry that I will flunk out of school
- When I begin an examination, I feel pretty confident that I will do well
- Worrying about doing poorly interferes with my concentration on tests

- I get so nervous and confused when taking an examination that I fail to answer questions to the best of my ability

When one considers that students who do not see themselves as 'smart' or able enough often adopt self-handicapping strategies or overcompensate with effort (Brooks, 1997), the centrality of self-concept to self-regulation is immediately apparent. The above items identify issues of self-awareness at an affective rather than cognitive level. Fear of failure and a general lack of confidence can breed intellectual defensiveness which can in turn hinder the development of self-regulatory skills.

Items that assess Self Monitoring

- I am up-to-date in my class assignments
- I compare class notes with other students to make sure my notes are complete
- I review my notes before the next class
- I test myself to be sure I know the material I have been studying

Self monitoring is a process that is dependent upon a level of metacognition since it involves students actively assessing their own performance. Whether viewed in terms such as cognitive self observation, Vygotskian inner speech or behaviourist self recording (Zimmerman, 1989), the ability to monitor one's own performance, plan, and compare with others, are key underpinning processes to the development of self-regulatory strategies.

Items that assess Motivation

- I would rather not be in school
- I only study the subjects I like
- When work is difficult I either give up or study only the easy parts
- I tend to spend so much time with friends that my coursework suffers

Motivation results from the actualisation of Self Concept, and the ability to maintain it is one of the main tenets of Self-regulation (Zimmerman, 1994). Difficulty in sustaining interest in learning can often be attributed to poor self concept, which may result from a number of factors, including poor appraisals from teachers (Boekaerts, 1997) but is manifest by a generally weak attitude towards a learning situation. Therefore, students with poor motivation will articulate a preference for other activities, and a reluctance to approach problems which may prove to be too challenging.

Items that assess Strategy Formation

- I make drawings or sketches to help me understand what I am studying
- I learn new words or ideas by visualizing a situation in which they occur
- I translate what I am studying into my own words
- When I study, I have trouble figuring out just what to do to learn the material

Cognitive learning strategies include rehearsal, elaboration, and organisational strategies, as well as memorization through clustering, imagery, use of mnemonics and so on (Weinstein & Mayer, 1986). As well as making sketches, and visualizing practical applications, deeper cognitive processes (such as transformation - the creation of something new out of existing information) are more successful than ones which engage in knowledge as a static entity, such as rehearsal (Risemberg, 1996). Strategy formation must come from the user rather than be dictated by the curriculum. If a student is unable to 'figure out' what to do to learn new material, it is indicative of an inaibility to form strategies.

Items that assess Volition Control Strategies

- Even when study materials are dull and uninteresting, I manage to keep working until I finish
- When it comes to studying, procrastination is a problem for me
- When I decide to study, I set aside a specific length of time and stick to it
- I concentrate fully when studying

Volition differs from motivation in that motivational processes mediate the formation of and promote decisions, while volitional processes enact and protect them (Corno, 1994). Therefore motivational self-regulation is dependent upon strategies that activate effort to achieve learning goals (Garcia & Pintrich, 1994). There are several strategies that students use to control effort. In a general sense, being able to avoid distractions and procastination can assist in students' staying on task, while more specific approaches such as setting aside specific lengths of time (sometimes combined with reward mechanisms) ensure the regulation of students' effort.'

Items that do not fit the model of Self-regulation

In the process of analysing the items that make up the LASSI questionnaire, many have been discarded. This is for a number of reasons. Some items are difficult to neatly categorise. The statement 'My mind wanders a lot when I study' would appear to measure a learner's lack of perseverence, but does not necessarily relate to volition control strategies per se. To claim 'I get discouraged because of low grades' may indicate a poor self concept, but the factors for this may primarily be external to the learner.

Some items, too, are open to multiple interpretations. The item, 'I have difficulty identifying the important points in my reading' may suggest poor literacy rather than poor strategy formation. One also needs to be careful when generalizing from statements such as 'I don't care if I finish school as long as I find a husband/wife'. It is tempting to interpret low self concept from such a statement, but there may be cultural or financial reasons to which the assessor needs to be sensitive. Ultimately, the process of distilling a pool of 77 items into 6 categories is a subjective one. A deliberately cautious approach has been adopted here. While many of the discarded items may still validly be used to assess self-regulation where there is any perceived potential for ambiguity they have been discarded.

Summary and Conclusions

With the advent of online learning and the push for life long learning, there is currently much debate focused on creating optimal conditions in learning environments for self-regulated learning, to help students develop as independent learners. However, providing appropriate learning environments and valid assessment instruments to monitor students' ability to self-regulate, as well as feedback and scaffolding on how to improve, is not an easy task for most tertiary educators.

This paper has provided a conceptual framework to help identify students' self-regulatory skills, as well as a mapping to a validated online testing instrument. It is our contention that this can form the basis of a pre-test, which could be administered to groups of students at the beginning of the semester, followed by customised feedback to each student with scaffolding to help raise their awareness and skills in areas of deficiency. A post-test could also be administered to help students reflect on their progress during the semester.

The test is not perfect. One important aspect of self-regulation is the influence of external factors. Some external attributes are hinted to in the LASSI instrument (for example low grades as a basis for poor self concept), and there is one statement which would certainly appear to directly tackle this issue: 'Problems outside of school – being in love, financial difficulties, conflict with parents, etc. – cause me to neglect my school work'. Nevertheless, LASSI is primarily a tool for assessing individual learning styles and does not directly accommodate external influences. It must therefore be acknowledged that LASSI test items may best be used to assess the internal processes that influence self-regulation rather than factors external to the individual learner. However, for the most part LASSI would appear to be an ideal tool for assessing the self-regulatory skills that are so crucial to students' success in an on-line environment. If this modified assessment tool does prove to be valid, it may be a more appropriate solution to purchase LASSI and use it for these purposes rather than to attempt to create a totally new instrument, that would need to be tested and validated.

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QUALITY ASSURANCE FOR ONLINE COURSES: FROM POLICY TO PROCESS TO IMPROVEMENT?

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Abstract

Over the past few years, RMIT has made a substantial investment into the use of online learning technology aimed at improving the quality of programs by reviewing their educational design and adding greater flexibility to modes of studying them. As part of this process, we have developed a university-wide quality assurance system for online courses related to aspects of educational design. All major online projects need to show evidence of sound and varied use of technology in order to achieve the educational outcomes desired. Peer reviews are carried out and a formal evaluation plan is written. The paper will describe the current policy and how it is being implemented at RMIT.

Keywords

quality assurance, quality systems, investment in online technology, peer review, evaluation

New Demands for Quality

Quality assurance is defined by Harman and Meek (2000, p. vi) as 'systematic management and assessment procedures … to ensure achievement of quality outputs or improved quality'. The Australian Quality Assurance Framework (online) is shown in Figure 1. Increasingly Australian universities will be asked to provide evidence for how they are maintaining academic standards and this evidence will be subject to audit. This will be the case for all delivered programs.

Many programs in Australian universities are delivered by a mixed mode with face-to-face teaching enhanced by independent modes of learning; many of these enhancements are now based on the use of web technologies. (Note that RMIT, like several other Australian universities, has adopted the nomenclature of programs and courses: program for the university's provision of an entire student educational experience leading to a formal qualification and course for the component subject, unit or module.) We have a growing reliance on robust technology which is simple for students to use and easy for academics to adopt and integrate in ways which can enrich students' learning. It is clear that we need to rethink ways of assessing and assuring the quality of the courseware produced using these technologies.

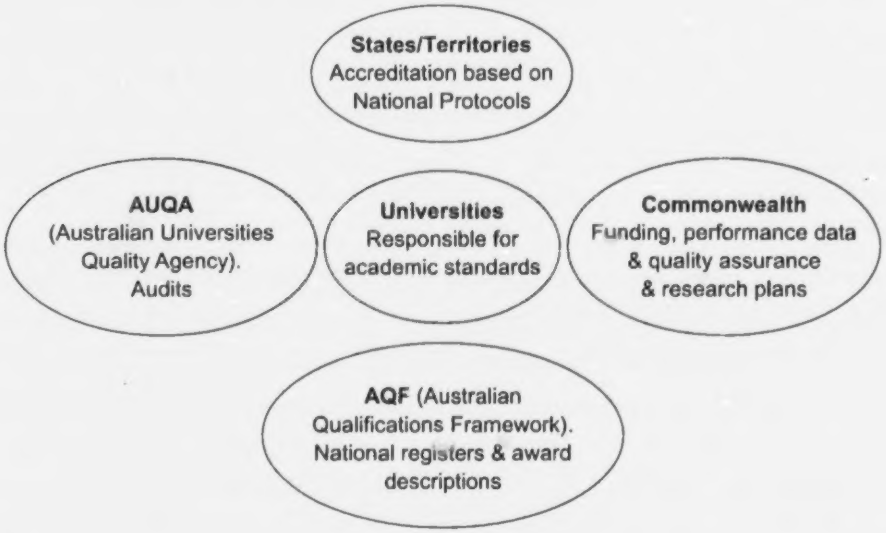
States/Territories
Accreditation based on
National Protocols
AUQA
(Australian Universities
Quality Agency).
Audits
Universities
Responsible for
academic standards
Commonwealth
Funding, performance data
& quality assurance
& research plans
AQF (Australian
Qualifications Framework).
National registers & award
descriptions

Figure 1: The Australian Quality Assurance Framework

Quality Online – What is it?

'How can a teaching/ learning process that deviates so markedly from what has been practiced for hundreds of years embody quality education.' This quote is from the pre-amble to the Institute of Higher Education (2000) report on benchmarks for success in Internet-based distance education; it encapsulates the huge changes that are rapidly taking place world-wide in teaching and learning practice. This case study of six US higher education institutions notes benchmarks that are seen as essential and benchmarks that are seen as *not* essential for ensuring quality online distance education. While the report focuses on distance education providers, we believe the findings are useful for institutions such as RMIT where most courses are taught by a mixed mode approach of both face-to-face and online modes. The benchmarks that are considered essential relate strongly to:

- clear planning;
- robust and reliable infrastructure;
- good support systems for staff and students, including training and written information;
- good channels of communication between staff and students;
- regular feedback to students on their learning;
- clear standards for courseware development; and
- ongoing evaluation processes with a strong student input.

None of these is surprising. It is the benchmarks that are considered *not* essential for ensuring quality online distance education that are more surprising to us 'old-school' teaching and learning advisers, such as:

- catering for students' diversity of learning styles;
- providing institutional rewards for effective teaching;
- having a strong team focus on course design;
- having collaborative and/or problem solving activities; and
- taking a modular approach to course design where student mastery of each module is expected.

To summarise, the essential benchmarks have a strong focus on systems and process. The non-essential benchmarks listed here relate to diversity and richness of educational design. While one can read too much into one study, there are messages here about not allowing our universities to become online qualification 'factories' in order to achieve certain specified university targets. The challenge is to meet those targets while still developing and maintaining rich and stimulating learning environments for students.

We do not believe that we have *either* a purely pedagogical approach *or* a purely financial perspective; we need both. For example, RMIT is really seeing the move to online teaching and learning as a financial investment, on which the University expects to get a return, mainly in terms of quality assured courseware to support strategic offshore teaching. Each faculty at RMIT has a list of its strategic programs and major efforts are going in this direction. A Return on Investment (RoI) will only occur if the courseware we use has high educational quality.

RMIT Context

Over the past few years, RMIT has made a substantial investment into the use of technology (for example, see Fallshaw, 2000). This initiative, called the Information Technology Alignment Program (ITAP) involves investment in infrastructure, enterprise computer-based systems, library resources, staff development, and program and course renewal (online). Through our Distributed Learning System (DLS) we offer staff a set of online tools to assist them in renewing their courses and subjects. An earlier report on RMIT's work (McNaught, Kenny, Kennedy & Lord, 1999) describes the toolset, early implementation experiences and early evaluations. We now have approximately 800 online courses in our system and several more on faculty servers that are yet to be migrated to central servers and incorporated into the DLS.

In order to develop staff capacity in using the DLS, a large scale professional development exercise has taken place. This has involved time release (26 days each), training and ongoing support for approximately 145 staff across the University, two or three in each department. In this time release period academic staff develop online materials and support their colleagues in their departments to engage with online teaching and learning (McNaught & Kennedy, 2000; McNaught, in press).

At RMIT, the vast majority of our courses are not fully online and involve mixed mode designs. These include traditional classroom face-to-face teaching, work-place learning arrangements (a central feature of many RMIT programs) and partnerships with other educational providers (especially offshore).

RMIT Policy: Quality in Educational Design and Production

We have developed a university-wide quality assurance system for online courses related to aspects of educational design. All online courses (no matter how minor the online component) need to be signed-off at faculty level by each faculty's Director of Teaching Quality (DoTQ). For this sign-off to occur, there needs to be *evidence of clear educational design and planning*. This online approval process basically asks staff to show evidence of some educational planning before their subjects become 'live' on the DLS. The DoTQs check that staff have considered the design features of an online system, have thought about the overall rationale for the course in question, and comply with basic publishing standards (including copyright matters). The coherence between the Course Guide and the online presence is a key criterion here. This is a minimal educational requirement and simply requires an assessment of that coherence. We use the Course Guide (this includes the usual information relating to course details, learning outcomes, planned student learning experiences, assessment and study program and an Online Checklist to do this (online). A short version of the Online Checklist is shown in Table 1.

Section A: Educational planning and design of online environments	
Topic	**Some examples to consider**
Learner-learner/ learner-teacher interaction	Online tutorial sessions. Feedback on practical work. Continuous evaluation form. Team assignments workspace. Moderated discussion forums.
Learner self-assessment/ feedback on learning progress	A current collection of assessment materials and supporting documentation. Samples of previous assignments/project work (with documented student permission). A collection of past/recent exams and sample tests (where appropriate). Self-help quizzes (for formative assessment purposes). Provision for electronic submission of assignment work. Publishing work for peer review.
Study program management/ study skills support	Direct access to the related approved Course Guide. A current timetable/timeline related to outlining face-to-face tutorials, lectures, lab/field work and online activities (with times, dates and location details). Online learning activities clearly described/linked to curriculum outcomes. Current contact details of lecturers, teachers and tutors. A structured collection of Frequently Asked Questions and/or Glossary. Lecture outlines Laboratory notes. News announcements.
Resource-based/problem-based learning environments	A structured collection of learning resources. Clear links to related Library resources and databases. A structured and validated collection of annotated WWW links. Multimedia simulations.
Section B: Online learning resource publishing standards	
To be completed if the DLS course contains a structured collection of online learning resources. Are the guidelines for the following areas addressed? • RMIT intellectual property and copyright (online) • RMIT 'identifiability' • Web site and interface design • Accessibility	

Table 1: Topics in the quality assurance checklist for online courses

At RMIT, each faculty has a list of strategically important programs. There is significant investment in developing or renewing the courses in these programs and online learning is a feature of this process. These 'strategic' courses need to demonstrate additional quality processes. These are:

- *evidence of peer review*. The Boyer (1990) Scholarship model has been used for some time as an integrating model for all RMIT work. The process of being open to feedback and scrutiny is essential in any scholarly activity and our key strategic teaching is in that category. A report of the decision made at peer review sessions is required.
- *evidence of forward thinking through an evaluation plan*. The evaluation plan is a requirement to indicate how important ongoing quality improvement is. While collecting evidence about the success of one's teaching and how much students are learning ought to be a natural

process, in reality evaluation is rarely rigorously carried out (Alexander, 1999). This part of the policy requests a brief document outlining what evaluation strategies are to be used once the course is being taught to students.

Developing Processes to enact the Policy

Evidence of Educational Design

As stated above, this evidence is needed for all online courses. There are two mechanisms that are used to support this quality criterion. The first is the production of exemplars. Here the growing number of developed 'strategic' courses is being used to provide examples to use with staff. As strategic courses have professional educational design and production input, the documentation of Course Guides is often more complete. One area where we are trying to improve the quality of the Course Guides is in the realm of graduate capabilities or attributes. How does one course relate to other courses? How does the design of each course contribute to the desired graduate capabilities? (online). The progressive building up of quality Course Guides and matching examples of online courses is a priority need. These are being added to a secure area on the Distributed Learning System (DLS), but more work is needed here.

The second mechanism we use, which is linked to the first, is the process of reviewing all DLS courses. We did this first in June 2000 when a review of 530 online courses in our DLS was carried out. This was prior to the new policy for quality assurance of online courses. There were seven Review Teams—one for each faculty consisting of faculty staff and staff from Learning Technology Services. Initially there was a great deal of suspicion about this 'police' activity, but, by having collaborative effort with staff in the Faculties, the exercise was seen as much as evaluative feedback as being quality control. However, the tensions between the two can be a fine line! We did not look at all online learning environments at RMIT; the Review Teams did not look at subjects still undergoing development, at subjects 'switched off' because they were not currently operating, or at online materials that still reside on faculty and departmental servers.

We used a checklist similar to that in Table 1 to do the review. Only about half the subjects were felt to be adequate and feedback was given to all course owners about where improvement could occur. The sorts of issues we provided feedback on were:

- lack of clarity in linking resources and activities to learning outcomes;
- lack of flexibility in catering for diverse groups of students;
- lack of linking to strategic priorities, e.g. internationalisation, work-integrated learning;
- no links to activities, just the provision of resources;
- extraneous buttons; and
- unclear navigation strategies.

We are currently reviewing about 800 courses in 2001. These courses should have had at least the basic quality assurance sign-off, though it is unrealistic to expect that this will have occurred rigorously at this stage. This review is again operating with collaborative teams at faculty level. Wherever possible, program leaders are being involved, so that the discussion about how well the linkages between courses operate can occur. This year more detailed information about the online design features being used has been collected. Faculties are now refining their own local quality processes. The detection of exemplars is obviously one outcome of the review process.

Carrying out Peer Reviews

We provide a range of optional proformas for this process. We have found these peer review sessions to be extremely valuable staff development exercises. Basically, staff gather in a computer lab, spend time going through partially or nearly developed online strategic courses, make comments and then have an open discussion. Most peer reviews are held over 1-2 hours. Below is a set of criteria that have been used in some peer review sessions.

- Students undertaking the learning activities (including assessment) are likely to achieve the course's learning outcomes.
- The course's learning outcomes incorporate relevant graduate capabilities. This means they are explicitly incorporated in learning activities and assessed (e.g. subject of reflection among students with feedback).
- The skills, knowledge and experiences of the students commencing the course have been considered when developing the learning activities, assessments and resources.
- The course meets the needs, wants and circumstances of the diversity of the anticipated students (including student access and equity issues in relation to computers).
- The course, including the online components, is sensitive to the local language and culture of the students (including English language proficiency).
- The course will actively encourage and support student interest, interaction and engagement.
- The assessment activities (including criteria) will clearly gauge the student capability or competency related to the desired learning outcomes.
- The course ensures students are aware of the expected nature and standards of assessable work.
- The course provides opportunities for timely and constructive feedback on learning to students throughout the course.
- At all times students know what activities and tasks to undertake.
- At all times students know what standards are expected and how to get learning support.
- Students can readily locate and access all resources when needed as well as readily submit material to peers or teaching team.
- The student is aware of the type of assistance available at any stage during learning and can quickly resolve common issues.
- Students are readily able to provide feedback to the teaching team throughout the course.
- The teaching and learning activities need to be selected and developed to maintain or enhance the expected benefits versus costs, including the ongoing costs of teaching and assessing in the course.
- All online materials conform to the RMIT Online Publishing Standards.

Developing Formal Evaluation Plans

Each department and group at RMIT produces an annual student feedback plan (online) but, as in most universities, the evaluation is focused mostly on measures of student satisfaction and there is little learning-centred evaluation done. We are trying to build up scholarly approaches to evaluation. RMIT is involved in the ASCILITE CUTSD evaluation project (online) and the evaluation framework outlined in Bain (1999) is influencing the proformas we prepare for staff. However, the work required must be feasible within already stretched academic workloads. Some strategies we suggest are listed below.

- Survey of all students about access to computers, basic computer skills and experience learning online.
- Ongoing discussion boards to allow students an opportunity to air any view. These need to be reviewed regularly by the Course Coordinator. Regular Course Team meetings to get an overview of issues arising.
- Regular survey about students' perceptions of online learning activities, access to and use of online resources and relationship to other parts of the courses.
- Focus groups, e.g. about structure of online courses (ease of use, functionality), online communication issues.
- Detailed discussion of assessment results to provide evidence of areas of the courses that students can master and areas that they find challenging.
- Program team meeting reviewing issues across first semester courses.
- Compilation of final report indicating recommended changes for next iteration.

Is RMIT Achieving Quality Outcomes in its Online Courses?

Anderson, Johnson and Milligan (2000, p. 60) warn against 'focusing too much on processes and not enough on academic standards and outcomes' in quality assurance plans. Are we really making headway? Is our online quality assurance policy resulting in better quality online learning environments? We are cautiously optimistic and, overall, we are satisfied with the processes we have designed. Here are some of the indicators that give us optimism.

- The DLS Review in 2001 is much more rigorous than that in 2000. It has been taken more seriously.
- The need to consider quality assurance issues for courses in relation to program level design and management is now more widely accepted.
- We have a much clearer idea of how to document and report on design issues to all stakeholders.
- There is little intellectual resistance to the need for an evidence of planning process (including copyright and intellectual property sign-off). The response of staff at workshops and discussions has been largely positive.
- The response and engagement of staff at peer review sessions has been positive.
- Twenty-five course teams will have gone through the full quality assurance process of evidence of educational design, peer review and evaluation planning by mid-2001. Another fifty should go through the process later in 2001.

However, we are unclear about how effective the evaluation plans are at this stage. The issue with the evaluation plans is that they may look scholarly and staff may have quite strong intentions to enact them. But once teaching is in place, it is hard to find time for serious evaluation. It is another process to add to the workload of staff … and therefore another challenge to embed.

One of the keys to the success of quality assurance systems is to have effective and efficient management of the process. This means that we need to be flexible and adaptive in improving the process. For example, we are developing online document repositories and online peer review processes. We have done this for our Global University Alliance (online) strategic courses and hope to use this as a model for other strategic courses.

Thus, improving our online quality links to improvement of our quality processes in a continuous loop.

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3D GAME SOFTWARE AND ARCHITECTURAL EDUCATION

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Abstract

The use of computer technology to simulate architectural designs is well established in the profession and education. However most software interfaces in this field are intricate and require substantial time input, while the hardware requirements to produce quality animations are continually expanding. This software / hardware 'squeeze' can have a detrimental impact in the educational context of the architectural design studios. Students start with high expectations and rapidly become disillusioned at the time it takes to transfer ideas to digital reality. Those who persist often produce seductive computer graphics at the expense of design quality. This paper describes an innovative architectural design course at the University of Auckland in which computer game software was utilised as the design medium. The preliminary outcomes indicate that this relatively inexpensive software may address the above problems and in addition offer other learning opportunities.

Keywords

architecture, education, creativity, computer

Educational Context

Computers are used for a wide range of tasks in architectural education. These tend to relate to course differentiation between technology and design which occurs in the majority of degrees. Technology subjects use software to measure and test building performance - for example the deflection of a beam or the lighting levels generated by lamps. This use of building science software is relatively straightforward and is not the focus of this paper. By contrast the use of computers to support the main activity of architectural degrees - design projects undertaken in studios - is problematic. What follows is a description of the nature of the problem encountered at the Auckland School of Architecture.

Auckland has established itself among the top design schools in Australasia with our students frequently successful in prestigious international competitions. Reviews by accrediting agencies often make comment on the excellence and innovation students demonstrate in drawing and model making. In my view this is due to the emphasis placed by most design studios on the close relationship between representation and the development of design ideas. The "mark - interpret - mark cycle" articulated by Daniel Herbert in relation to sketching has been extended within our design studios to the production of innovative composite drawings and malleable physical models (Herbert, 1993). While not a certainty our experience has shown that innovative representation generally produces innovative and sophisticated architectural projects. These observations are reinforced by the work of theorist Robin Evans who in "*The Projective Cast*" traces the relationship between projective geometry and the generation of architectural form (Evans, 1995). In this work he proposes that the historical development of architecture has been limited by the ability to describe form on paper, and hence related to the drafting tools and techniques available at any given period.

Evans' historical perspective has been used by the author to propose alternate strategies facilitated or made possible by the use of digital technology (Moloney, 2000). These were categorised as *emergent form* (using generative techniques such as cellular automata, shape grammar or genetic algorithms), *immersive editing* (the editing of architecture within virtual environments) and *computer aided construction* (the automated construction of architecture using CNC machines). These three strategies are to my mind the advantages of computing for design. While the first involves computer programming beyond the curriculum of most schools and the later requires specialised and expensive machines, the facility to evaluate and alter architectural design - immersive editing - is within the resources of typical architecture schools.

As the principle lecturer responsible for computing my goal was to encourage the use of immersive editing to aid student design projects. The first step was to move the computers out of the computer lab and into the design studio. A relatively simple and logical move once nervous technicians and academic staff were persuaded of the need to integrate computers with other forms of representation in the design studios. A major hurdle however was the drawing culture which pervaded the school at the time. Freehand sketching is an activity that in the twentieth century has acquired mythical status for Architecture. After Le Corbusier the sketch is seen as a 'divine' moment of creation marking the spontaneous birth of the architecture, a mysterious ability that some have and some do not. Hence the 'table napkin' doodles (pre or post natal) which inevitably accompany the documentation of an architectural project. In this culture of drawing excellence the use of computers tended to attract students who were more interested in mastering every last software command than using the computer to develop their design projects. Three or four years ago the hunched figure of the 'computer geek' loomed large in both staff and student perception. Today the position is to some extent reversed. Our most talented students put in the long hours of interface pain and hardware time to generate work that has gained international recognition. However while computers are now associated with design excellence they still form a marginal percentage of student projects. Most students are discouraged by the time and effort required in the production of refined projects.

In discussion with students the most traumatic experience was the long anxious wait for hardware to produce renders only to find either design mistakes or technical errors such as lighting have ruined their work. The time lag between computer 'mark' and interpretation hindered the creative process and in the worst cases resulted in sub standard work. The obvious answer is to work in real time - so called virtual reality – rather than evaluate designs via rendered animations. Indeed the concept of immersive editing was proposed on the assumption of a real time editing environment. Unfortunately virtual reality software and the hardware requirements are still beyond the resources of most undergraduate degrees.

Game Software

Computer game developers have huge resources to bring to their research and development and as a consequence their products offer performance that rivals commercial virtual reality software - at a fraction of the price. Recently several games have offered 'level' editing - users can design their own scenes for the game play to unfold. It was now possible to design architecture using game software. After evaluating options we decided to use 'Worldcraft Toolkit' which is used to generate 3D scenes for the games 'Half Life' and 'Counter Strike'. A major advantage of 'Worldcraft' is that the modelling navigation is identical to the game navigation interface. Hence new design ideas can be instantly evaluated, edited and refined with fluency. It was anticipated that this would encourage experimentation and design modification throughout the design process. In order to test this proposition a design project was proposed for a summer design elective undertaken in January 2001.

The project was structured in two parts. A preliminary project required students to select an unbuilt work from a list of master architects and construct an accurate 3D model. The primary objective of this short project was to gain software fluency without the pressure of design. Another objective was to gain an insight into the work of their chosen architect and hence provide a precedent or referent for the next project. In this second design task students were required to produce an architectural proposal which referred to the previous model. The analogy of 'cousins' was presented for individual interpretation. Students were encouraged to exploit the game software to push the boundaries of architecture - the project did not necessarily have to be 'buildable' but should propose ideas and possibilities for architecture.

Outcomes

Design Iterations

In this first trial the anticipated benefits were achieved. Once students realised they could alter their projects and instantly examine the 3D consequences from any point of view, most produced a series of ideas which were discussed in tutorials. Students were encouraged to make file copies as they advanced these designs to provide a record of these iterations. The range and scope of iterations differed from student to student in a similar manner to non-computer based design projects. Research on creativity in architectural design has indicated a relationship between creative ability and the range and number of design permutations - the more creative solutions generally come from students who are prepared to critically examine a large number of iterations (Schoon, 1992). Hence the importance of using software which encourages immersive editing.

As well as these anticipated benefits the use of the software resulted in other outcomes of potential importance to the use of computers for architectural design education.

The Critique

Student projects culminate in a formal critique by invited critics who have not seen the work. In previous projects we have undertaken students would present with a combination of hardcopy prints and screen animations. The experience of the game critique was radically different. As 'Half Life' is a multi player game environment the critics manipulated avatars to follow the student around and engage *within* the architecture. Hence the critics were invited to experience the architectural proposal in a participatory manner as opposed to passive viewing and listening. This enlivened the whole process, relaxing the student and critic and encouraged conversations about aspects of the work to evolve. The process was one of mutual discovery, breaking down the normal power structure of architectural critiques - students standing in front of seated critics and endeavouring to 'sell' their project. This was of particular advantage to some 'English as a Second Language' students.

Design Emphasis

The tools available within the gaming environment affected the emphasis of the student designs. These included experimentation with surface qualities to produce in the best cases extremely seductive light and opacity effects. (Our visiting professional critic left inspired to seek out real world materials that would achieve these effects). Other students experimented with differential gravitational fields that challenged the position of the 'occupant'. Some inserted hidden triggers to animate walls dependent on proximity. 'Teleports' were embedded to transfer the occupant to other parts of the building, while others engendered a sense of danger via traps or breaking building parts. In one instance the student declared to the critics that her work could only be appreciated by continually running through the project as opposed to analysis from a fixed viewpoint. In summary, the above student experiments facilitated by the game software resulted in an emphasis on the *experiential* attributes of the architectural proposals. Students could simulate the sensual experience of design occupation as opposed to traditional evaluation through architectural codes of plan, elevation and section.

Further Work

This first experimentation indicates there are potential advantages in the use of game software. In particular the *immediacy* of the interface and the low hardware requirements address problems encountered with professional software typically used in architectural schools. Further work needs to be undertaken to explore the full potential of the software. In the next stage of this teaching experiment it is proposed to use the software to facilitate virtual design studios in which student and tutor can inhabit work in progress via the internet. We also see the possibility for collaboration with computer science departments to reprogram the game plot to provide a more educational focus to the game narrative.

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SEEKING PERSEVERANCE THROUGH CLOSER RELATIONS WITH REMOTE STUDENTS

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Abstract

The application of communications technologies for educational purposes has provided opportunities for academics to enhance their relationship with their distance education students. This paper provides an interim report on the outcomes of a deliberate strategy by an academic to make use of technology to build rapport with his students and to monitor their progress and performance. The preliminary findings from this particular case study have wider applicability in that they suggest that students are more likely to complete their studies if they have a sense of commitment to others with whom they have bonded throughout the course of their learning experience.

Keywords
student retention, learning community, online learning, student support

Introduction

Despite the best efforts of institutions to retain students in their courses, the part-time students at a distance remain more likely to leave their courses than their full-time on-campus counterparts (Morgan & Littlewood, 1998). This is not surprising as there are several important differences between the two groups, all of which weigh heavily against the distance students continuing with their studies. These factors are well known and include realities such as students at a distance being far more likely to have compelling family, employment and community responsibilities than their full-time on-campus counterparts. As a result their personal priorities will be different and allocating time to studies relatively more difficult.

While teaching staff and their institutions can do little about some of these factors, there are aspects of the climate in which the distance learner operates that can be influenced. Individual students make a personal decision to persist or not to persist in their course through weighing the positives and negatives operating within their particular context. The personal decision each student makes in this regard involves the interplay of positive factors which encourage them to continue and negative factors which push them towards withdrawal. Thus for those on the point of withdrawal, the decision whether or not to persist can be affected by even a slight tip in favour of the positive side of the experience as a result of efforts expended by the institution.

The Value of Affiliation

The quality of the distance education experience suffers in comparison with its on-campus equivalent due to issues of affiliation, status, recognition and empowerment (Mahony & Morgan, 1991). Being a distance student is more likely to bring with it feelings of isolation, little sense of being part of the learning community, and a sense of unreality. Such students may see themselves as lone individuals, of lower status and lesser importance within the university community. This can reduce their pride in being a tertiary student, their sense of affiliation with other students and their institution and its staff, and their commitment to persevere. The weakness of these bonds of the student to the institution and to the community of learning immediately increases their propensity to dropout.

The building of a sense of affiliation among their distance learners must then present fertile opportunities for providers. It seems reasonable to expect that if institutions and individual tutors gained improvement in this area then higher completion rates could well be a reward. Initiatives in this area could tip the balance more towards persisting with their studies for some students who may be hovering on the brink of withdrawal. Those not so much at risk of withdrawal can be expected to sense a benefit from an elevated quality of their educational experience.

The Project

A small project was implemented among students at a distance in a financial management unit of study at the Orange campus of the University of Sydney in a deliberate attempt to improve the quality of their learning experience through building a greater sense of community and affiliation. The strategic use of the WebCT platform that had become available offered the lecturer the opportunity to interact with students in an ongoing manner. This was viewed as an opportunity to provide the factors necessary for high quality support for distance learners as cited by Cowan (1994), that is, timely prompting, encouragement and facilitative interventions.

The regular distance presentation utilising printed study materials was supplemented by the use of the WebCT platform. While this supplementation was made available to all students only a minority were able or chose to make use of it. In the first year only 11 of the 51 enrolling students participated and in the second 15 of the 59.

Studies, such as that by Wood (1995), have shown that students are often keen to receive electronic messages but less willing to initiate them to others. As the lecturer's purpose was to make use of the technology to build a sense of community among the participating students, it was important that all felt comfortable about using it. In an attempt to "break the ice" all participating students were asked to prepare and electronically submit to the group their own short informal profile. Those who did not respond were individually contacted by email and further encouraged to do so. This prompting continued until everyone had complied, including the lecturer. This early activity had an added benefit for some as it served to ease their anxieties regarding the use of an unfamiliar technology.

The lecturer anticipated that email traffic initiated by students would be light. As Bielema (1997) reports, it is essential for the tutor to be prepared to intervene and revitalise electronic discussions as the exchanges wane. If there were to be a low level of email traffic then it was expected that little sense of community would develop among the group. Consequently the lecturer made a personal undertaking to initiate a considerable degree of contact using this medium with both the group and individual students in the group.

The lecturer regularly sent group messages throughout the semester when the unit was on offer and generated on average one such message each week. The nature of these varied and messages included matters such as requests of students to respond with details of their study progress, general items of news around the campus and in the life of the lecturer, notification when the lecturer would be away from the office and difficult to contact, and progressive assessment performance details over the whole unit so that individuals could monitor their own performance against the total enrolment. The tone of all messages was conversational and students were encouraged to send their own group messages.

Each time students responded to a group message or else initiated one themselves, the lecturer sent them an individual encouraging response to ensure they registered that their contribution was received and appreciated. When students did not reply having been requested to do so in a group message, then these students would be followed up by email on an individual basis until they did reply. Additionally the lecturer initiated enquiry messages to individual students when they were later than expected in submitting their assessment items or when he had not heard from them for a while. He would also send personalised messages of encouragement to students who had done particularly well or particularly poorly with their assessable work.

Other facilities available through the WebCT platform were utilised such as asynchronous forum discussions whereby challenge questions were posed, synchronous chat sessions, models and links. The thrust of the project however was to have frequent, regular, personalised interactions between the lecturer and the student. Some management features were:

- The lecturer assigning this task sufficient priority to enable the checking of the site at least twice each day. Rapid response was regarded as a quality issue in this project.
- Monitoring of visits to the site to enable identification of students who had not been in contact for some time. These students would be sent a personalised message by the lecturer either enquiring about some aspect of their study progress or following up on a previous interaction.

Student Impressions

At the end of the semester, an independent third party evaluated each of the participating student's experiences. Students in both offerings overwhelmingly responded that they enjoyed the interactions with their lecturer and looked forward to them. They acknowledged the relatively low level of interaction between students but were not particularly concerned about this.

Of particular interest is the fact that the students found their interactions with their lecturer motivating. They commented that because of the relationship they had developed with their lecturer they made time for study when they did not think they had any available. They said that the regular contact kept them on task and helped them maintain study as a high priority among competing obligations.

Students again responded positively when asked whether or not the online interactions contributed to their sense of affiliation. Comments included the removal of the loneliness associated with feeling isolated and the sense of belonging to a learning community with other students and staff close at hand.

Effectiveness of the Intervention

The survey of students clearly revealed that they felt they mattered to the lecturer, benefited from his intervention, and considered their bonds with the institution were strengthened. Quite clearly the quality of the distance education experience for these students was elevated.

In terms of the effect on persistence, the low numbers of students involved does not lend itself well to formal statistical analysis. Nevertheless some interesting observations can be made. In the first offering 80% of those students in the unit not participating in the online supplementation completed the unit. By way of comparison, all eleven students in the online group completed. Of these, two volunteered the opinion that they would have been unlikely to persist had it not been for the regular communication they received. In the second offering 13 of the fifteen students (87%) participating in the online component completed while only 71% of the others completed.

Two comments by students in the course of the first presentation highlight the impact of the affiliation that developed among the participants. The first comment came to the lecturer half way through the semester and indicates the sense of duty that arises when a union between the student and lecturer develops:

> *I feel obliged to get my first assignment done and handed into you because we have been corresponding so regularly...in my case it has given me the motivation to get this far.*

The second is a reflective comment sent by one student to the whole group upon her completion of the unit and attests to the need students have to be part of a learning community:

> *I must say that this unit is the best I've studied...particularly because of our tutorial group which prevented a feeling of being alone out here with no idea even that anyone else was doing the same unit.*

Conclusions

The regular, personable and committed use of communication technologies with those studying at a distance can build positive relationships. This approach is clearly of value for students who avail themselves of it and rewarding for staff who enjoy the challenges that teaching in a distance learning environment at university brings. An outcome of having more satisfied students for the university is that it can lead to stronger student/university bonds with its consequent advantages. It also appears that the social bonding that can develop between students and staff, and to a lesser extent between students, may lead to higher completion rates. By taking a personalised approach using the technology, the academic can be involved with each student and have a positive effect on study activity and perseverance.

The demands on staff choosing this approach are significant and it requires of them a sustained, regular and sensitive commitment. Unless the staff member is prepared to make such a commitment then it is unlikely that the potential the technology offers will be realised. As Rocklin (2001) points out within this context, university teachers are unlikely to be able devote a lot more effort to their teaching than they already do. Thus the realities of contemporary academic workloads will likely limit the capacity of the lecturer to provide the commitment required for learning enhancements such as this.

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SHOWCASING THE EXPERIENCE OF PRACTITIONERS WITH TECHNOLOGY-ENHANCED TEACHING AND LEARNING

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Abstract

This paper describes a research project, which seeks to showcase the experience base of practitioners with technology-enhanced teaching and learning. A particular focus of this investigation is how the use of information and communications technology is influencing teaching practices and students' approaches to learning at the University of Melbourne. This investigation is a naturalistic inquiry into the experience base of academics who have been engaged in technology-enhanced teaching and learning. Our goal has been to look beyond objective data and to ascertain how information and communications technology is fundamentally influencing the nature of the teaching and learning transactions. As such we are interested in the "untold" stories of practitioners and participants in this work. Data that is collected is archived on a website that is maintained by the Department of Teaching, Learning and Research Support. This website is designed to be a dynamic archive that is maintained on a continuing basis and used in a variety of ways, including use in faculty development activities.

Keywords
evaluation, practitioner experience, technology-enhanced teaching and learning

Aim of this Paper

Universities are just beginning to pay greater attention to improving one of their core functions (ie. teaching and learning) with the innovative use of information and communications technologies. Consequently, there is a lack of reliable knowledge about *what* works, *why* and in *what ways*? This paper describes a research project that is trying to seek some answers to these questions. The goal of this project is to look beyond data from student questionnaires and into the experiences of a selection of *practitioners*, to ascertain how ICT is fundamentally influencing the nature of the teaching and learning process in various subject matter domains. As such its aim is to tell the "untold" stories of practitioners and participants. The stories we collect, and the profiles of practice that we develop will comprise the data for the development of conceptual models of best practice. These models will then form the subject of empirical study in the future.

The outcomes of this research are expected to be a deeper level understanding of how the use of ICT is influencing teaching and learning in fundamental ways. In that regard, this is "exploratory" research as it seeks to compile stories of the experiences of teachers and students with technology-enhanced teaching and learning. As an immediate output, these "stories" or "vignettes" of practitioners will be used to build a "gallery of stories" on technology-enhanced teaching and learning that will be accessible on a website for the benefit of all, but most importantly, for novices. Furthermore, models of behaviour and practice derived from this research will provide the context for more empirical studies in the future, such as the study of any correlation between innovative teaching and learning designs and specific learning outcomes, and/or approaches to learning and teaching.

Methodology

This investigation is a naturalistic inquiry (Lincoln & Guba, 1985). Naturalistic inquiry, logically enough, is carried out in a natural setting where the context is heavily implicated on meaning. Such a contextual inquiry *demands* the use of human instruments for gathering data. Human instruments have the capacity to use their tacit knowledge combined with qualitative data gathering tools such as *interviews, direct observations, self-reporting and think-aloud, document analysis*, and other *unobtrusive measures*. Once in the field, the inquiry takes the form of successive iterations of four elements: *purposive sampling, inductive analysis* of the data obtained from the sample, *development of grounded theory* based on the inductive analysis, and *projection of next steps* in a constantly emergent design (Lincoln & Guba, 1985, p. 187). Throughout the inquiry, and especially at the end, the data and interpretations are continuously checked with respondents, and differences of opinion are negotiated until the outcomes are agreed upon or differences of opinion are understood and reflected as such. This information is then used to develop a report of the case. The case study is primarily an interpretative instrument for what was found there. It is tested for "credibility", "transferability", "dependability", and "confirmability" from early on in the study and continuing throughout (Lincoln & Guba, 1985, p. 189).

Procedure

Interviews comprise the principal instrument for collecting the stories from practitioners. Although a set of trigger questions formulated around the action learning cycle is used to conduct the interviews, on the whole the interviews are fundamentally reflective and conversational in nature. These interviews are audiotaped and then transcribed. The trigger questions for the interviews are used to extract pertinent content from the text of the transcribed material. Once completed, these are presented to the interviewees for assessment of their accuracy, credibility with regards to what was being represented and overall confirmation as a true representation of their experience with technology-enhanced teaching and learning. The confirmed profile is then prepared for entry into the database, which provides a forum for the stories of practitioners with technology-enhanced teaching and learning at the University. This website is housed in and maintained by the Department of Teaching, Learning and Research Support in the Information Division.

Format of the Profiles

The main thrust of each story uses the following action learning processes—*planning, doing/ taking action, observing* and *reflecting*. A number of trigger questions are used to form the basis of the interviews. Contributors are encouraged to provide links to other resources relating to their project.

Trigger Questions

Planning

1. What were your goals and motivations?
2. What about teaching and learning you were trying to influence *(eg. innovative approaches to content presentation, activation of learning, assessment, socialisation, or provision of feedback)?*
3. Why where they important and to whom and what?
4. Describe your approach to learning and teaching in relation to this project?
5. What unique challenges did you face in planning your approach?

What you did

1. How did you go about choosing the tools and technologies?
2. What influenced your choice of these tools and technologies?
3. What challenges did you face in selecting these tools and technology?
4. What limitations did you experience, financial, technical or organisational?

What happened

1. What worked and didn't work?
2. What criteria you used for evaluating the effectiveness of your progress?
3. How did you make use of the data that was gathered?

What you learned

1. How did this innovation influence your view of teaching and learning?
2. In what ways have you changed in the way you think about your teaching?
3. How did it influence your students' approaches to studying and learning?
4. Did it impact your understanding of your students' studying and learning?
5. What are your successes, failures, serendipities, lessons learned?
6. What would you do differently next time?

Sample Profile

Planning: Goals and Motivations
As teachers we were keen to see if there were other ways in which we could engage with our students that would be different, interesting, and challenging for both us and them as well.

Planning: Approach to Learning
We were using a different approach to teaching and learning and assessment, and which relates to the issue of engaging students in the interaction.

Planning: Challenges
Trying to engage students using multimedia is a big challenge. It's a bit easier being in the class with fifteen other people talking about whatever the subject is and being challenged, hearing other points of view, engaging in that process, as part of your professional development.

Doing: Choice of Tools
The driving issue was finding tools that would enable us to bring together theory and practice in an accessible, challenging, and hopefully an interesting way that mirrored the practice in the discipline but would be accessible to students.

Doing: Challenges in Selecting Tools
Finding tools that would enable us to engage with students and present them with an interesting mirror of practice, without having to send them back to the field.

Doing: Limitations Experienced
The biggest stumbling block was time and also the perception among those who are not involved in these sorts of developments directly, and that is that having developed them once, they are done.

Observing: What Criteria for Success Were Used
The obvious ones were, did it make our work more enjoyable, and did the students like it.

Observing: How Those Criteria Were Measured
We engaged in some post LaSWOP debriefs among ourselves. We also examined data from an online discussion, and individualised email-based feedback.

Reflecting: Impact on Your View of Teaching and Learning
What we are trying to do is mirror practice, and practice does change. I am certainly acutely aware of the need for my students to engage with the material. I think that has translated, in an indirect sense, into some of my other teaching in lectures and seminars.

Reflecting: Impact on Your Student's Studying and Teaching
Well that has always been a critical issue in social work education. I think that this project has certainly helped to sharpen and focus our attention on that issue.

Reflecting: What Did You Learn
A regret that we have is that it has taken as long to get this far. Perhaps better planning and technical assistance and know-how in house would have helped.

Website Development Process

Data gathered with interviews is presented in a website targeting University of Melbourne academics. Fields in this database include standard metadata, such as the names and affiliations of faculty and projects, discipline areas, aspects of teaching and learning that are being impacted by each project, technologies used, and dates of implementation.

These predefined categories include displays of reflections on various aspects of the teaching and learning processes for individual projects, as well as displays of multiple stories on similar goals and/or processes. The user is also able to search for stories on particular discipline areas.

Browseable lists include projects by faculty and department, as well as by the predefined action learning processes. This allows users to view the reflections from varying perspectives. Search functions provide for user-constructed views of the data to enable investigation based on specific interests. Key word searching is also available within all fields of the database.

Each story segment is displayed with fully linked metadata for the corresponding project. This allows users to connect to other Teaching, Learning and Research Support department databases containing technical and project information, or to contact the academics involved with the project. Links are also made to live web content where this is appropriate.

The presentation of this paper will comprise a short demonstration of the website.

Concluding Remarks

The work that is described and discussed in this paper grew out of a growing call for "evidence of the impacts" of information and communications technology in tertiary teaching and learning. While this is a question that has been asked many times before, answers to it have not been conclusive one way or the other. There are also suggestions that the acclaimed benefits do not justify the cost, time and effort that this kind of work entails. Many of these findings are however, problematic as they are based on neither reliable nor valid search techniques. The work that is reported in this paper incorporates investigation techniques that depart from the commonly used approaches to the quantification of user perceptions with questionnaires and surveys of sorts.

Our goal in this work is to capture the experience base of practitioners with the use of a range of data gathering techniques that are grounded in the principles of naturalist inquiry. We realise that data derived from these kinds of approaches are not easily "generalizable" to other contexts. But then "generalizability" is a function of sampling and we expect that over time, we will have in this gallery, the amount of information and data that is necessary to make meaningful generalisations from it to similar situations and contexts. We anticipate that this gallery will grow into an extremely rich resource of the experience base of not only many of our pioneering efforts but some of the most innovative work that is being undertaken in this regard at the University of Melbourne.

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THE DEVELOPMENT OF ONLINE LEARNING AT UNITEC – SAME ENVIRONMENT, NEW LANDSCAPE?

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Abstract

UNITEC's short history in the field of online learning provides a story of changing attitudes and usage at three levels - organisational, tutorial and student. From the first course designed for flexible delivery in 1994, UNITEC has progressed through three distinct phases of course development. As of the middle of 2001, UNITEC has over 300 courses that are completely online, or have some element of online delivery or support for students, ranging across all five academic faculties. To support this rapid increase in the use of the medium, a number of organisational changes have been made, along with a programme of professional development and tutor and student support.

This paper looks briefly at the process of growth, and the changing nature of ongoing tutor development. There have been significant changes in the way tutors use the course delivery interface and the professional development programme has tended towards more active support of the issues of teaching and learning. We report on some of the lessons learned, the difficulties that have arisen, and look at some of the challenges for the future.

Keywords

flexible learning, online learning, online course development

Introduction

UNITEC Institute of Technology in Auckland has a relatively short history as a tertiary education provider, dating back to its inception in 1976. As Carrington Technical Institute, the institute was mainly trades-based, focusing on Applied Skills trades such as automotive, plumbing, building, interior decorating and boat building. In 1994 the institute was re-named UNITEC Institute of Technology, signaling an aggressive move into the more academic streams of tertiary education. UNITEC now (mid-2001) offers 17 undergraduate degree programmes, 6 Postgraduate Diplomas, 5 Masters programmes and one PhD, from four academic faculties. In conjunction with the diversification of programmes offered at the Institute, there has been a progressive uptake of web-based technologies to support teaching and learning. This progression has occurred in three distinct stages – see the overview in Table 1.

Development stage and approach	Number of courses	Time period (and actual development time)	Development team*	Purpose of web-based material	Main course elements and features
STAGE 1 Custom-built online courses in isolated departments	3 (approx 18 months)	1994 – 1998	Lecturer, programmer	Replace existing distance course, facilitate collaborative assignments, enable better class communication and faster access to more resources	Course notes, course information, student journal for individual assignments, email, listserv, web resources.
STAGE 2 Custom-built online courses across faculties as funded projects	10 (3 completed)	1998 – 1999 (12 months)	Lecturers, programmers, project manager, educational designer, graphic designer	Supplement classroom teaching. Port all theory material to the Web and make it more interactive. Introduce students to Internet. Introduce online collaborative assignments. Provide self-assessment mechanisms. Monitor student use.	Course notes, course information, student journal for individual and collaborative assignments, discussion board, self-testing quizzes, interactive tutorials, web resources, student tracking system.
STAGE 3 Online course development using web course management systems (WCMS)	250 – 300	1999 – 2001 (approx 2 weeks – 2 months' development time)	Lecturers, with support from learning technologies specialists	Supplement existing on-campus courses to provide more flexibilty, supplement existingdistance courses, provide new distance/ flexible courses.	Courses and course elements with consistent interface (of WCMS). Common elements such as announcements, Discussion Board, course documents, course information, group pages, student drop box.

All course development has been for groups of 20 to 300 students.

Table 1: Summary of development mechanisms and courses

1994 – In the Beginning: the First Online Programme

In 1994 the first flexible, online programme – the Diploma in Educational Technology – was developed. In New Zealand, a Certificate, Diploma or Degree "programme" is made up of a number of "courses" where a "course" is the equivalent to an Australian "unit" and consists of approximately 300 hours' study. A separate paper (Halliday, 2001) at this conference reports in more detail on the development of the Diploma since 1994.

1998 – Online Course Development Projects in all Faculties

By 1998, pressure was starting to be applied by individuals from other departments around the campus to provide web-based courses or components of courses for their students. A few tutors and Heads of Schools had already done some ad hoc development of courseware using a variety of web editing applications such as DreamWeaver, FrontPage and NetObjectsFusion. The Department of Learning Technologies proposed a more co-ordinated and consistent approach. A programme of educational design and development services, together with release time for content specialists within the faculties was agreed with the Institute's Senior Management Team. Plans were drawn up to produce ten online courses within the first year. These ten courses were selected from a number of applications across the institution, based their suitability (in terms of strategic and pedagogical factors) for web delivery. These courses would be developed on a project basis, by teams of faculty experts, an educational designer, programmers, a graphic designer and project manager.

While there was plenty of initial enthusiasm from the faculties, much of this waned as the realities were realised. Three courses did see elements of full development and delivery, but the production fell short of the expectation for a number of reasons:

- In some cases the development teams had high expectations of interactive multimedia-type functionality being achievable on web pages. In the early stages the ratio of educational design time to programming time ranged from one hour of educational design time requiring 40 to 80 hours of programming time. While many of the complex routines were re-usable across projects, this amount of development time was unsustainable given the small development team available for each of the ten projects.
- Funds that were allocated to faculties for the release of teaching staff were not always used for that purpose. This put increased load on the teachers concerned, and contributed to the withdrawal of some from the project well before there was any significant development.
- Iinsufficient design and programming staff within Learning Technologies contributed to some projects being incomplete or delayed.

While it is easy to point to inadequacies in this approach and its execution, some excellent work was completed, and three of these modules are still being used three years later. It was also a period that allowed much to be learned about the realities of online course delivery.

Results of formative evaluations conducted throughout this phase informed subsequent designs of the online courses. These results also showed what was required to support staff and students in the use of these new modes of delivery (e.g. printed staff and student "how to" guides, and course-specific orientation exercises to introduce students to the user-interface and functionality of the online modules). Feedback from questionnaires, classroom observations and focus groups with staff and students revealed that while students found many of the online components fairly useful, these materials needed to be introduced and supported in a more structured way. A consequence of this feedback for one course (on Business Computing), was that the "theory" (taught in lecture theatres) and "practical" parts (taught in computer labs) of the course were integrated so that all teaching took place in computer labs. This enabled students and staff to make more use of the online components in all parts of the course.

Assessment of online course work raised new issues for some staff, who tended to make the online course components supplementary and voluntary to start with, and then found that only the most conscientious students used them. The integration of online components with existing courses was a challenge for the on-campus courses (as opposed to the flexible or distance courses); not only for the tutors who had been part of the online course development teams, but also for the tutors who had not been directly involved in this development (and most of whom were new to online learning), but who had to use the online modules in their teaching.

The authors feel that this early "project phase" was an integral and necessary part of the process for the Institute in coming to better understand the reality of committing to web-based access to courses for students. We believe that many tertiary institutions (in New Zealand at least) are still at this stage, and are understandably working through this and looking for more efficient systems.

1998 – Evaluation of Web Course Management Systems (WCMS)

By the end of 1998 it was recognised that the current system would not support a larger scale move to flexible course delivery for the Institute. There were a number of key reasons for this, including:

- The cost of development time and resources far outstripped the benefits in most cases. Experience thus far showed that one course took at least six months to develop, with a part-time commitment of at least three members of staff. Even if web "templates" were used to enable similar web features to be created in different courses without support from design or programming staff, we could not foresee how this cost could support larger scale online course development activities.
- Technical dependence for most staff became a hindrance to ongoing maintenance and development of courses. Whenever changes were required the tutor had to channel requests through a programmer, which involved a time delay and further cost implications
- The potential for supporting the growth in online courses as expected by the Senior Management Team (10% of all courses by the year 2000) was clearly unachievable.

This realisation led to an evaluation of a number of commercially available Web Course Management Systems (WCMS). One of the key requirements of such a system was that the teaching staff should be 'technically independent' as far as possible. We believed that placing the development tools in the hands of the tutors, and reducing the technical learning curve as much as possible, would remove one significant obstacle to the growth in online course delivery to students (other obstacles to tutors "going online" are discussed briefly later).

Cost was also clearly a factor in the choice of the WCMS. Without a proven history and experience in the support of distance students, it was difficult to justify a large investment initially. After a careful study and analysis of many course development frameworks (a total of over 40 were identified initially) a decision was made to adopt the Blackboard system for the campus as a whole. At the same time, WebCT was also being trialled within one department, allowing both systems to be tested within the UNITEC environment.

The main attributes that initially pointed to Blackboard being the preferred choice of WCMS included the following:

- It was (in our opinion) the easiest to use for tutors, providing the most direct and least difficult path to course development.
- No extra software (other than a browser and Internet access) was required for either the tutors or students. Most development could be completed without the assistance or intervention of technicians or programmers.
- Most development could be completed without the assistance or intervention of technicians or programmers.
- A one-off cost provided unlimited courses and enrolled students, keeping the cost to the Institute relatively low at the early stages.
- Support from the Blackboard company appeared to be efficient and comprehensive. The early stages of installation and deployment of the system went relatively smoothly, with Blackboard technical staff generally answering queries by email within 24 hours.

While Blackboard was promoted as a course development tool for staff across the Institute, the network infrastructure for online courses was maintained so that other course delivery software could also be trialled and used if tutors wished to use alternatives to Blackboard.

Promoting the Use of the WCMS at UNITEC

The use of the Blackboard WCMS at UNITEC was promoted widely to teaching staff in a number of ways. A series of introductory workshops were held to provide an awareness of what was possible in an online learning environment. Most of the staff who attended were essentially new to the concept of online learning and web-based access to courses. Many used these workshops to just start thinking about its application to their courses and their teaching practice. Demonstrations of the software were also given at a number of departmental meetings, where staff could reflect with their peers on the potential of online learning.

The major impetus for the uptake of the WCMS came in the first instance from those who were already using the Internet in some form to support their courses. Two of the School of Education courses that had initially been custom-built in the first phase of UNITEC's web-course development were converted to Blackboard. This was not totally satisfactory, as features such as individual student journals could not be exactly duplicated in Blackboard. The trade-off for these tutors was the independence it gave them from technical support required for ongoing course development.

However, the "early adopters" were often isolated in their teaching departments. Institutional policies and procedures for online teaching were not yet in place. These tutors were taking risks in a new educational terrain and they needed professional development and support. One of the approaches to meeting this need was to promote the concept of a 'champion' in each of the five faculties who would co-ordinate technical and pedagogical support, and be the key contact person for administrators of the WCMS. This was achieved to some extent in all five faculties. The most effective example of this role was one faculty where the "champion" or "online teaching co-ordinator" was released from full-time to part-time teaching (0.5 of each). When this position was changed back to a full-time teaching position for one semester, the lack of progress in online course development in that faculty for that semester was clearly evident.

Strategic support from the Senior Management Team was vital at this stage, with Deans and Heads of Schools being given a very positive message about the future and impact of web-based access to UNITEC courses. It was important that tutors who wanted to develop their online components for their courses should get support from their managers, even if this was simply tacit approval, without the tangible support of time release that most would have liked.

A study of factors that UNITEC staff believed were most important for online course development (Holley, 2001) reflects the needs described above. The majority of respondents (n=46) indicated that the five most important factors for online course development were (in order of priority):

1. Time allowance
2. Staff development workshops
3. Basic computing skills
4. A faculty-based co-ordinator, and
5. Management support

The First Growth Spurt

Many staff came to workshops or departmental presentations, saw, were interested, then went away to think more about the implications of this new mode of delivery. Many were justifiably cautious about increased workload, and skeptical about the real worth of this system for them and their students. But many more were also excited about the prospect of providing an extra dimension to their courses, and added flexibility for their students. Some had very practical reasons for becoming interested – they were teaching remote groups of students in areas such as Wellington, Christchurch and individuals in rural areas; students were in practical placements, such as teaching and nursing students; students were in remote South Pacific islands; or they were teaching elite sports students who were travelling internationally with representative teams.

As a consequence of the meetings and workshops, there was a rapid rise in the number of "course shells" being created in Blackboard. These were "empty courses" that had a registered tutor but no content and no enrolled students. Some departments decided on a full-scale commitment to this form of development and had shells created for all their courses at once. Others were more reluctant to take such a strong stand, and left it to individual staff. Figure 1 shows that within the first year of adopting Blackboard, over 250 course shells were created. At this stage the tutors were becoming keenly aware of the fact that the quantity of online courses was seen as important. Quality was in many cases a casualty of this drive.

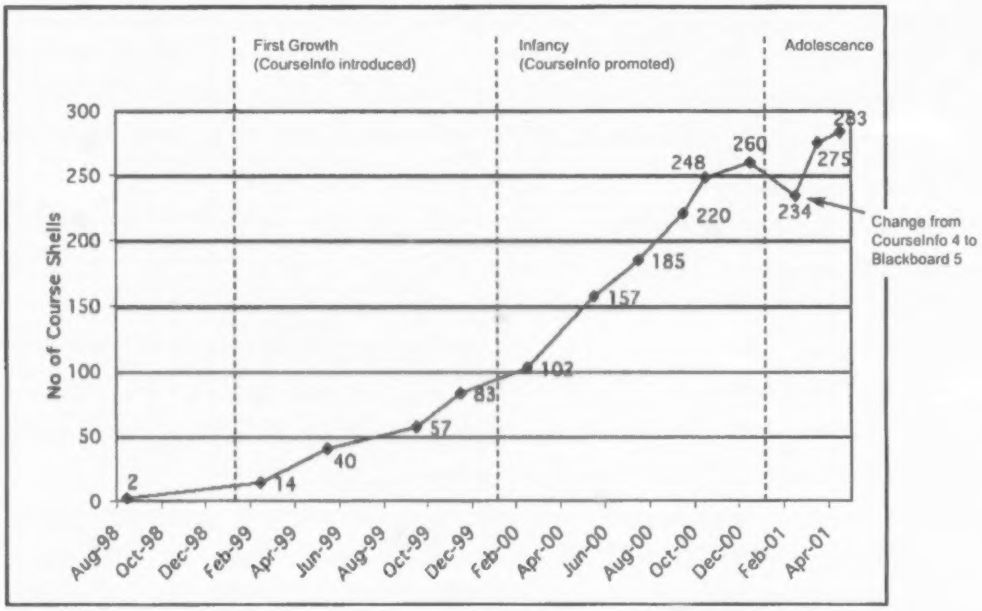

Figure 1: Growth of UNITEC online course shells from August 1998 to May 2001

It was inevitable that many of the courses created in the first flush of enthusiasm were not well conceived or designed, and most gave little indication of being 're-designed' to take advantage of what the web could offer to enhance the learning process. The development approach to many of these early online courses was technology-driven, rather than pedagogy-driven. While some tutors were quite happy to view the Blackboard shell as a means of flexible content delivery, others were keen to learn and think more about the ways in which the web could add value to the teaching and learning process. Both anecdotal and research evidence revealed that the courses that were being developed in depth were clearly showing the value of integrating web-based activities into the normal class-based activities. For example:

- The quality of students' assignments rose sharply in some cases.
- Tutors reported benefits of online teaching such as working more collaboratively with their peers, and being relieved of many tedious administrative and formative assessment tasks.
- Some students from non-English speaking backgrounds were more confident about participating in online activities, given the opportunity to write their answers and reflect on these, and to check the correctness of their language before posting contributions (Rainsbury & Malcolm, 2001).
- Students appreciated the rapid feedback provided by self-study quizzes.

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Infancy

As more and more courses were "going online", there was an increased student expectation of web access. In the early stages of this growth, a number of initiatives were tried to encourage uptake by both tutors and students, including:

- To promote the ideas of 'best practice', a Blackboard Users' Group was formed, inviting all users of Blackboard at UNITEC to attend monthly meetings. The main purpose of these meetings was (and still is) to share ideas of best practice between practitioners, as well as to update users about new versions and any other issues of a mechanical or technical nature. Individuals from within the group have been encouraged to take a role in submitting an agenda for each meeting. The ongoing effectiveness of this meeting depends largely on the involvement and enthusiasm of its participants. The general feeling is that this is a very useful time, although there are still many tutors who do not attend.
- A second series of meetings was held with tutors on a department basis to discuss the underlying teaching and learning principles of the online environment. A number of issues were raised in these meetings, including the use of Discussion Boards, the place of Group Work, and the issues of online Assessment. There was also useful discussion of issues such as copyright, workload and collaborative teaching. Tutors were being encouraged to make the step towards online teaching for their own reasons – i.e. to 'jump' rather than being 'pushed'.
- A student handout was produced by Learning Technologies, to be available for all staff to give to students at the beginning of their course. The handout covers aspects of access (logins, passwords, etc), help (who to go to for what), minimum system requirements (for Mac and Windows computers) and the features and activities available with Blackboard. We are currently in the process of producing a staff equivalent, as an easy guide to course preparation.
- The champions identified within each faculty, were encouraged to act as a more direct support link to their colleagues (than was available to the limited number of Learning Technologies staff). In at least three departments, these champions took a very proactive role in promoting and supporting tutors to make the most effective use of Blackboard. In other cases, the interest and uptake within the faculty has not been enough to maintain the momentum of this role. In these cases, Learning Technologies has generally provided the support directly.

Adolescence

The beginning of this year (2001) brought a major upgrade to version 5 of Blackboard. The process of transferring courses to the new version provided the opportunity to rationalise the list of courses on the server. It was decided that those courses that had been created on the server and not developed to any extent, should be archived and removed. All tutors were approached about the status of their courses, and in some cases this was a spur to renew interest and development. This rollover did see a substantial drop in the number of courses hosted in the new server – a number that has continued to rise steadily again this year.

At the same time, a more consistent and reliable enrolment interface was developed with the Student Management System – PeopleSoft. In the previous system, it had been left to each instructor to add their own enrolments to their class. This had led to a number of inconsistencies and confusion with students' user names. By using PeopleSoft to export a list of enrolments to Blackboard, the "userid" was made the same as the student logons to the campus network. There were a couple of fairly major and inconvenient hiccups at the inception of this process, but these were soon ironed out, and the system has been running smoothly since. The major inconvenience of this process is that instructors no longer have access rights to create accounts. Any non-standard accounts, such as other instructors or students who are not officially enrolled at UNITEC, now have to be created by designated system administrators within Learning Technologies.

A link with the campus IT Help Desk has allowed students to get more immediate assistance with logins, passwords and basic course access. A local UNITEC help database has also been developed with FAQs, hints and tips, and direct email contact for students to a person at the Help Desk. This link to the Help Desk was essential in the rush of access difficulties at the beginning of the year. At the same time, Learning Support documentation was built into a web-based course, for which all students were automatically given access. Library collections and databases are also available online, directly from all web-based courses.

For the teaching staff, a more comprehensive range of workshops has been developed and delivered, largely focussing on the pedagogical aspects of teaching and learning. Discussions of good teaching practice are linked to the features and activities available with Blackboard, as well as taking a more detailed look at the potential of Discussion Boards, methods of moderating online discussions, Groups, web resource links, assessment, and meeting quality standards of web design and educational effectiveness. We have also created a couple of 'play-room' courses – courses to which staff have Instructor access, but with the understanding that they are only for trial and experimentation purposes.

Some key issues that our staff currently face in their online teaching include:
- Their changing role as tutors.
- Integrating new online teaching principles with existing teaching methods.
- Motivating students to take on responsibilities unique to online learning.
- Evaluating the effectiveness of new teaching methods to inform future practice.
- Similar issues have recently been identified in a British study of undergraduate and postgraduate online courses by Boyle and Cook (2001).

A professional development website about effective online learning is being developed, and invites contributions from other staff members. This resource applies a number of learning models (proposed by Reeves (1997), Pearson and Green (1999), and Herrington and Oliver (2000)) that promote student-centred learning and the use of authentic tasks to achieve personally relevant and meaningful learning outcomes. Emerging research on and models for effective online learning environments, are continually being reviewed.

A number of tutors are now working collaboratively with other off-campus instructors. A handful of UNITEC courses are being taught in conjunction with overseas universities, and access to these courses can be made easily and readily to the overseas tutors.

Maturity – Does it Exist?

If we follow the logical progression from infancy, through adolescence, the assumption is that we reach some form of maturity. If maturity implies a plateau in development, we don't believe that it exists in the development of web-based courses. The further we progress, the further the horizon extends, and we adjust to take advantage of a new landscape. There are a number of developments which encourage us to feel more confident about the way in which we are using and supporting online learning:
- The ever-growing number of students who expect web access to their courses will demand a greater and more comprehensive uptake of online course development by tutors.
- The tools and features within the WCMS must support an effective online learning environment. Any compromise on educational standards will doom online learning to failure. As tutors and students all become more experienced and more discriminating in their use of the tools, the more we will learn as a community to use and apply them to better meet our learning goals. Course and tutor evaluation instruments for online courses are currently being developed, as well as a set of quality standards for our tutors to use as guidelines.
- A number of New Zealand secondary schools (including the Correspondence School) are starting to make extensive use of the web as an online learning environment. UNITEC has provided a Blackboard server with free access for schools to host materials for, and communicating with, their students.
- Within New Zealand (and Australia) the number of educational institutions adopting some form of web course management system is also growing rapidly. As the body of experience with this form of development grows, so (hopefully) will our confidence and expertise in using it.

It is our hope and expectation that the community of educational providers in this part of the world will work together to promote better teaching and learning using the increasing bandwidth and the infiltration of the Internet into our society and across all sectors of education.

The Future

In recent weeks (through August 2001), the service of Blackboard for UNITEC students suffered a severe loss of performance. While our system was never out of action, time delays meant that it might as well have been. Students were taking twenty minutes simply to log on to the system. When the root cause was finally fixed, after a number of hardware and software adjustments, tutors were surveyed for their attitudes to the Blackboard environment.

Initial results from a survey representing about 20% of all Blackboard courses at UNITEC suggest an intention to continue increasing the usage and application of Blackboard. Only 17% of respondents expected to have no increase in their use of Blackboard, while 33% expected to have more courses, 33% expected to have more students, and 67% expected to be using more of the Blackboard activities next year. Attitudes were also surprisingly positive for both tutors and students. Only 25% of tutors rated their students as negative or reluctant; 17% were enthusiastic, with the majority (58%) rated as keen but concerned about access speeds. With the speed issues addressed, this group would be listed as positive about their experiences. The tutors were overwhelmingly positive in response – 62% still enthusiastic and 38% keen to continue using Blackboard, with no tutors reporting a negative attitude to continued use of Blackboard.

With these stated intentions, UNITEC approaches the next year or two of online course development with renewed commitment. The performance issues of the recent past have provided the spur for ensuring that Blackboard is adequately resourced – it is no longer a research and development project, but an essential component of the teaching and learning for our students. We must anticipate an increasing number of students and courses, though this increase promises to be steady rather than exponential. From a pedagogical perspective, it is also encouraging and gratifying to see increasing levels of use of the interactive elements of Blackboard – the discussion boards, external links, groups and student grades in particular. The challenge for us is to encourage the thoughtful and appropriate use of these activities as cognitive tools to enhance the learning environment of our students.

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ENGAGED LEARNING: USING CONCRETE SIMULATIONS TO TEACH ABOUT AN ONLINE WORLD

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Abstract

When IT resources are scarce or in high demand, whole class or large group activities using learning technologies can be logistically challenging. A response to this challenge is to devise creative 'low tech' teaching strategies that can still powerfully explore terminology and issues encountered in the online world. In this paper we describe several such activities that have been used successfully with tertiary students in the University of Melbourne's B.Ed Primary course's Computers and the Primary Classroom subject.

Keywords

innovation, overcoming limitations, creative solutions, teaching strategies, internet, emerging technologies, computer education

Passive vs. Engaged Learning

When IT resources are scarce or in high demand, whole class or large group activities using learning technologies can be logistically challenging.

This applies not only in developing nations where access to computing equipment may be limited, but also in countries like the United States and Australia where for socio-economic or budgetary reasons certain schools, institutions and sections of the community might have reduced opportunities to participate in the new information-based economy. A 1999 report of US Department of Commerce concluded that Americans on the wrong side of the so-called Digital Divide are about 20 times more in danger of being 'left behind' (Irving, 1999).

The easiest response to this challenge has the instructor demonstrating the technology at the front of the class, with students passively looking on, perhaps taking notes but not actually engaging with the concepts presented. *Project Pegasus*, an IT initiative of Edmonton Public Schools, Canada (1999), encourages educators to overcome these limitations in more creative ways, asking educators to think about the difference between engaged and passive learning.

In a nutshell, *passive learning* involves lower-level thinking skills such as comprehension and recall, focuses on content rather than the process and is generally physically inactive. This sort of instruction is a component in many tertiary courses.

Engaged learning involves processes of inquiry, problem solving and creativity in which the student works both with other people and materials. However if computer resources are limited – or even non-existent – the challenge is to find or develop materials for students that will engage them and enable them to gain an understanding of and confidence in online technology.

One response to this challenge is to devise creative 'low tech' teaching strategies that can still powerfully explore terminology and issues encountered in the online world. To be effective, these activities must *engage* students in learning, whether or not technology is used.

Following are several 'low tech' activities about the Internet and online technology we have used with teacher education students in the University of Melbourne's B.Ed (Primary) course's *Computers and the Primary Classroom* subject. These activities have also been used with Primary School students, and as part of inservice activities for practicing Primary School teachers. (The photographs included in this paper are of Year 4 primary students participating in the *PaperNet* activity).

These activities are effective because they start with existing reference points the students understand. Abstract concepts such as hosts, packets, glitches, security, anonymity, confidentiality, acceptable use, 'spam', the perils of 'chatrooms' and even cyclical redundancy checking become clear when students use concrete objects such as balls, pens and paper, and each other to explore the issues. By engaging in the learning process, the students are able to gain an understanding of issues relating to being online and how the Internet works, in ways passively listening to a lecturer standing at the front of the room – or even watching a slick multimedia presentation – cannot.

PaperNet

PaperNet, an activity co-developed by the first author (O'Brien & Nicola, 1998) is a 'pen and paper' exercise that introduces issues raised by online chat and email.

If an organisation is developing an Acceptable Use Policy, active engagement in this exercise could help the participants involved understand the implications of such a document.

In this activity each participant is given a number – that represents their 'email address' – and sits in a large circle, facing outwards (Figure.1). The participants send 'email' messages, written on paper, to the others that are delivered by participants inside the circle representing the 'network'. Because (initially) no-one knows who anyone else is, those taking part gain an understanding of being participants in a chat-room.

Figure 1: In the PaperNet activity, students gain an understanding of chat rooms

Later, the participants sit facing inwards and repeat the exercise. Because they now know who they are communicating with, it is like sending and receiving email.

Following the *PaperNet* activity, complex issues can be discussed and explored further. During a debriefing discussion questions that might arise include:

- *What are the advantages/disadvantages of being anonymous on the Internet?*
- *How easy is it to pretend you are someone else? What are the implications of this when communicating online?*
- *Should ISPs be responsible for what people say to each other over the net?*
- *Did anyone send or receive a bogus message? Discuss the implications of this kind of online behavior.*
- *How do we know someone is who they say they are? Should we give our personal details out over the Internet?*
- *What things can we do to make using the Internet safe?*

Second year B.Ed (Primary) students participated in the *PaperNet* activity. Following the debriefing discussion, they were asked to reflect on how participating in such an activity might help a novice user's understanding of how the online technologies actually work. Reflections by B.Ed students included:

- *"The illustration and parallel between the game and the reality of email is really concrete and visible. It is solid demonstration, rather than a teacher just talking about it."*
- *"The activity makes a sophisticated 'invisible' procedure visible, accessible and easier to understand. The working demonstration of email can integrate into the participants' preexisting knowledge."*
- *"It is a very good and simple way of introducing and demonstrating how seemingly complex technology works. I like the way it gives you an idea of what is possible."*
- *"Users can see that there is a whole lot that happens to emails that are sent across the net before they get to another computer. It goes through a delivery process by third parties and things can happen to it during delivery. Information can be seen by others, lost or tampered with."*
- *"Participants see that caution needs to be taken when chatting/communicating on the Internet as users can assume a 'fake' identity. Similarly there is an etiquette to follow."*
- *"This game helps understand how something like a network that can't be watched or easy views actually works. That the system can crash, and you may not receive a message."*
- *"It shows how online communication works by breaking it down into a simple and easy to understand format. Anyone can send a message to you, if they know your email address and that crashes are sometimes unavoidable."*

Here are some additional comments by Year 4, 5 and 6 students (aged 10-12 years) who played the *PaperNet* game. At the time – just as their school was embarking on an ambitious project where it would eventually serve as a model for 'best practice' in new technologies (EkinSmyth, 1998) – none had ever used email or chat before:

- *"I liked the first Internet game the best because no one knows who you are and you can annoy people. I also liked being a networker."*
- *"The Blind game was the best because I couldn't see who I was writing to. I got an email saying, 'Who do you love?' I wrote 'Tom Cruise' as my answer."*
- *"I liked the second game because I got lots and lots of mail. I got a letter that I hated. It said, 'You've got lovely eyes'"*
- *"It was hard being a networker, there was so much mail to deliver I couldn't handle it."*
- *"Someone asked me if I was a boy or a girl, and I said that I was a boy when I'm really a girl. It was fun pretending to be someone else."*

Other Activities

Stephen Gard's *The Internet: A Resource for Australian Schools* (Gard, 1998) has been a useful resource. In a game called **Internet Ball** the participants stand in a large space in a grid pattern. Each participant represents a 'host' in the 'network'. The aim of the game is to pass a ball – that represents a message sent over the Internet – from one end of the grid to the other, as fast as possible. Hosts unexpectedly become afflicted by 'glitches' and become non-functional, and an alternate host must be found.

This activity demonstrates the original purpose of the Internet: to create a highly reliable system for data communication. If one host in the system is knocked out, there is always another to turn to and the message gets through.

Another effective activity from Gard (1998) is **Packet Panic**, a game that demonstrates how messages are passed over the Internet in 'packets', with 'error-checking' to ensure that the whole message has been passed, and that its parts are reassembled in the correct order at the receiving end.

This is similar to the childhood game where a child is given a message and it is whispered to the next child and so on until the last child tells the group the message they received, which after passing through a succession of players invariably ends up different to the original.

Where Packet Panic differs from the children's game is that the 'sender' and the 'receiver' also maintain a dialogue in which they compare notes about what's been sent: any lost or damaged packets are resent until the message is complete and correct. The activity vividly demonstrates that modern data transmission techniques ensure almost error-free message handling (cyclical redundancy checking).

Creating a Scaffold of Understanding

Activities such as these can be useful anywhere where IT resources are scarce or in high demand. Students must learn to use technology well in context. By immersion in engaged learning activities such as these activities and others like it, students create a scaffold of understanding by operating within paradigms they are comfortable with. Abstract concepts can be explored, discussed, and dissected. Technology novices can gain confidence and awareness of what awaits them in the online world, even before they have access to a computer or the Internet.

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LEARNING OBJECTS: SUPPORTING FLEXIBLE DELIVERY OF ONLINE LEARNING

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Abstract

There are now many educational organizations and institutions that have decided on flexible delivery and online learning as strategies that they are keen to pursue. While many educators value online delivery of programs for the flexibility and opportunities offered, the environment offers far more than these outcomes alone. Online delivery supports and encourages very powerful learning environments and has the prospect to transform education if approached in the correct fashion.

Across the world, conventional approaches to the design and development of online learning environments in higher education frequently result in many lost opportunities for both teachers and learners. These losses often arise as a consequence of a failure of many teachers to see the "big picture" when creating their own learning settings. This paper seeks to explore this big picture by examining the notion of reuse and recycling in online learning. It explores the concept of learning objects and how these can and should be considered in the design and development stages of online learning. The paper discusses outcomes and presents findings in the context of the Australian Flexible Learning Framework Online Product Development, Review and Evaluation project, a large Australian project seeking to develop world-class online learning products.

Keywords

World Wide Web, flexible delivery, instructional design, learning objects, online learning, reusable resources

Introduction

For many years, people have been critical of the development processes often used in building instructional and educational software systems (eg. Bates, 1999). In many instances, the development has resembled that used in cottage industries where a small number of people take responsibility for all aspects of the process and where the product is destined for small-scale use in limited settings (eg. Hanley, Schneebeck & Zweier, 1998). Bates (1999) uses the term *lone ranger* to describe much of the development occurring in educational institutions where many enthusiastic novices work independently on small scale projects to support their own teaching.

Many barriers exist to hinder the move to online learning. Among these the major impediments are recognised as stemming from the organisational factors associated with systemic change (eg. Anderson & Downes, 2000). With the increased uptake of online delivery within education, many writers are now questioning conventional development strategies and exploring more efficient and more productive ways to design and develop online learning materials. Strategies and activities that are currently being used in different settings to create more cost-effective solutions for online delivery of educational programs include:

- the development of national frameworks to support and develop online learning resources (eg. Anderson & Downes, 2000; ANTA, 2001; Education Network Australia, online);
- the development of libraries and databases of online learning resources for sharing and reuse, for example, Ariadne, MERLOT, LRX: and SoURCE, (all online);
- consortia among institutions to create larger markets, for example, Universitas 21 (online); and
- the development of specialist organisations that broker instructional materials, technical delivery support and learner support services for institutions (eg. Farrell, 2000).

Within and among all these various activities, there is a high degree of activity that extends across all phases, from design and development of online learning materials through to implementation and delivery strategies. It is within the context of design and development that this paper is set. There is growing recognition that the design and development strategies of online learning materials have to this point been very insular and localised and people are beginning to recognise the advantages of more open and outward looking approaches. In particular, the forms of design and development undertaken are starting to follow some fundamental patterns and processes that provide scope for reuse and recycling of the constituent elements. Critical to the success of many of these activities is the concept of learning objects.

Learning Objects

With the proliferation of online learning courses and materials, the Web is now replete with vast amounts of duplicated data and information. Early designers of Web-based materials focused heavily on developing online content and the majority of Web courses were based on delivery of these resources. Current design processes are now looking to maximise the reuse of learning materials and this has led to a number of reconsiderations in terms of the design and development of online learning settings.

Reusable learning objects are now being seen as the fundamental components and building blocks of online learning courses. A learning object is any entity, be it digital or non-digital that may be used for education and training (IEEE, 2001). In the context of online learning, these objects take such forms as Web pages, pdf documents, database applications, animations, Java applets, PowerPoint presentations and QuickTime movies. In the context of the Flexible Toolboxes, learning objects take a broader context and form and are defined more in terms of their educational properties, for example as learning elements, modules and assessment items.

The concept of online learning courses based around the use of reusable learning objects selected from large databases and repositories is not new. Even before the advent of the Web, such visionaries such as Ted Nelson (Nelson, 1965) and Roy Stringer (Stringer, 1992) were describing settings where information and course design was based on the use of resusable objects taken from interconnected digital libraries. The development of the Web has made possible such visions and much of the contemporary work in the field of online learning design and development is based, or influenced, in some way by the concept of such entities.

The entities needed to realise the visions of reusable digital objects are, in essence, digital forms of conventional libraries. Emerging storage and networking technologies have contributed significantly in recent years to the development of quite powerful functionalities for digital and multimedia libraries. The development of standards for the storage, cataloguing and classification of digital elements has significantly enhanced the discovery and delivery capabilities of the digital data within these networked systems.

Within educational contexts, the development of learning objects as an underpinning characteristic of the design of online learning environments involves two main considerations in the design process: the design of learning tasks and the selection of learning resources. While the concept of learning objects is relatively easily discussed and described in general terms, it becomes a little more complex in the operationalisation stage. In this stage, it is essential to discover the precise forms that learning objects can take.

Contemporary Learning Designs in Higher Education

Contemporary online learning development in HE is moving away from the notion of learning settings being comprised of pages of electronic text, to more deliberately planned learning designs, learning tasks and processes structured in deliberate ways. In previous settings, instructional design had focused on developing pathways for learners through learning content, whereas in contemporary settings the designs are now focussing on providing learning activities that bring about planned learning outcomes.

In previous settings, learning content was chosen in the initial design process and the instructional design concerned itself with creating tasks and challenges that helped learners to understand the content being presented and to consolidate their knowledge acquisition. In online settings, these types of activities tended to represent situations where students learned from the information presented by, and through, the technology (eg. Dehoney & Reeves, 1999).

In contemporary settings, instructional design places far less emphasis on content and information as knowledge to be learned. It looks to the provision of learning designs that guide learners through roles and responsibilities that reflect real and relevant applications and contexts. A principal aim of the instructional design is to create student-centred settings that support students' development of self-learning, metacognition and collaboration with others. The content becomes a means to an end rather than an end in itself and learning is mediated by the technology applications (eg. Duschatel, 1997).

Contemporary forms of instructional design can be well supported by the concept of learning objects. The critical factor required for success is the separation of learning designs and learning resource (eg. Oliver, 2001). In conventional settings, learning objects have tended to contain a blend of information and instruction. Instructional designers have previously been inclined to create learning materials where the voice of the teacher was carried through the description of the content. While this created a perfect setting for an instructional text, it created very limited settings for learning and even more limited settings for reusability and reuse of the learning materials.

The learning environments that promote the objectives of contemporary teaching are well supported by online learning settings constructed with learning objects (eg. Downes, 2000). Some learning objects can be used as the framework for learning designs while others can be used as the resources to support learning.

Objects for Learning Design

There are a number of software tools available today that can be used to develop online learning environments based on particular learning designs. In this context, a learning design represents a deliberate set of learner activities and roles within a specific context whose completion is likely to bring about the development of particular forms of knowledge, skills and understanding. A role-playing activity is a good example of a learning design. It represents a planned and coordinated set of tasks within a setting, the process of which will cause conceptual change among the learners. The levels and forms of conceptual change will depend very much on the background of the learners, their roles and responsibilities within the activity and the forms of collaboration, articulation, reflection and self-regulation involved.

Learning designs can often be described in decontextualised fashions but are always applied in a specific context. It is possible, for example, to build a learning object to act as a framework for the role playing activity described above. The object might take the form of a Web-based database that a teacher could use to create a setting for a particular subject context. The information and content required to support the role playing learning activity could also be learning objects chosen from a repository. The overall learning setting for the whole activity could be delivered to students through a standard courseware delivery system, such as WebCT or Blackboard. Such a system would also provide various forms of learner support such as discussion boards, noticeboards and chatrooms supporting the various forms of learner interaction.

The Australian Flexible Learning Framework Online Product Development, Review and Evaluation Project

There is currently a large amount of development activity surrounding Web-based materials that is looking to promote and encourage the notion of learning objects as the building blocks of online learning settings. A major project within Australia that is promoting these principles is the Australian Flexible Learning Framework Online Product Development, Review and Evaluation project funded through the Australian National Training Authority (ANTA) under the five-year strategy plan of the Australian Flexible Learning Framework (online).

The mission of ANTA is to ensure that the skills of the Australian labour force are sufficient to support internationally competitive commerce and industry and to provide individuals with opportunity to maximise their potential. ANTA's agenda has been to deliver training more responsively and efficiently and to a wider catchment area (ANTA, 1998). The Authority recognises that technological advances have been the catalyst for new forms of educational and training communication systems and that the demand for, and supply of vocational education and training is globalising. Consequently, it has enacted and sponsored strategies to encourage the vocational education and training providers to provide more flexible, technological-based, delivery for domestic and international markets. ANTA recognised that implications of technology advances and globalisation required new ways of creating and customising training material (Eccles, 1998). The Toolbox initiative was one of ANTA's strategies to encourage development and delivery of more flexible learning materials for the training market – particularly for online learning. Since 1998, ANTA and the Australian VET sector has invested over $20 million in "toolboxes" with the aim of producing a smorgasbord of multimedia resources from which providers can pick and choose in designing online training programs (Eccles, 1998).

The setting of a national framework with many discretionary elements provided a perfect opportunity for the Australian National Training Authority to explore the concept of online learning and in particular flexible forms of resource development and delivery to support learning. In the first instance, any products developed in this setting would have widespread application providing significant economies of scale. Secondly, the use of online technologies appeared to provide and promote the many forms of flexibility associated with the delivery of the Training Packages in the national setting.

The guidelines describing the Toolbox philosophy are aligned very much with those of the design and development of learning objects. Toolboxes are expected to allow for wide applicability across the target audience for whom they are intended. For this reason they are expected to be flexible, portable to a range of delivery platforms, and readily customised. They are designed to be:

- developed with readily available non-proprietary development software to facilitate customisation and reuse;
- developed with HTML code where customisation can be anticipated, with more sophisticated development software (eg. Flash) reserved for components that are unlikely to be changed;
- platform independent resources which allow for maximum portability to delivery platforms;
- devoid of rigid structuring devices locking the learner into particular learning pathways;
- developed using a file and directory structure that facilitates the location or selection of a particular learning object, as well as the use of the whole Toolbox;
- usable across a variety of platforms and browsers;
- consistent with the W3C content accessibility guidelines; and
- to embrace the EdNA metadata standard, a variation of IMS metadata standards used in the Australian educational setting.

The experience of the Australian Flexible Learning Framework Online Product Development, Review and Evaluation project to date has involved the development of online resources for over 25 Training Packages. This has been an enormous undertaking and represents the development of online resources for nearly 500 discrete units of study. The experience of the project has been to identify some critical factors associated with the design of flexible online learning resources which support customisation, and reuse, the principal characteristics of learning objects. These factors are summarised in Table 1.

Characteristic	Evidence in Design
Interoperability	Interoperability describes the capacity of items of software or hardware to work together. In the context of online learning, interoperability is usually associated with the design of Web-based resources that can operate across various forms of hardware platform, browser type and courseware delivery system. In the design and development of Web-based learning materials, interoperability can be considered at various levels. Some strategies supporting interoperability include: use of HTML standards; prescriptive use of Javascripts; use of plug-ins; use of standard screen sizes and colours; use of styles and style sheets; and standardised file organization and structure, file naming conventions and file sizes etc.
Organisation	Online learning environments are comprised of many individual elements. In order to be reusable, these elements need to be organised and classified in ways that encourage and facilitate discovery and relocation. A critical factor in designing learning settings that encourage this is the use of metadata standards. These standards need to be applied in consistent and reliable ways to ensure the integrity of the resources in instances where they are sought for reuse.
Scalable Use	Often when online resources are developed, they are designed with the immediate context in mind. Reusable objects need to be designed in ways that are flexible enough to cater for levels of use that may exceed (or fall within) the immediate setting. Scalable materials can be used with cohorts of 10, 100 or 1000. When scalability is not considered in the design phase, reusability can become quite limited.
Customisation	Reusable learning objects can serve many new purposes if there is some scope in their design for their use in alternative contexts to be considered. Customisation of learning objects can take many forms including teachers being able to choose between elements, making minor textual changes to elements, changing Web links etc. In instances where different forms of use for the objects may exist, customisation is enhanced by the provision of choices and options in the forms of application made.
Learning Designs	The design of learning objects where the instructional elements are separated from the resources and media elements provides many opportunities for reuse and resource sharing. The separation creates the possibility of customisation of both the learning activities and the supporting resources and high levels of flexibility in the choices made about each. The use of generic learning designs is an invaluable strategy supporting this characteristic.

Table 1: Characteristics supporting the design of reusable learning objects

The Challenges

As well as demonstrating the strategies and processes that can support the design of flexible learning settings based on reusable learning objects, the Australian Flexible Learning Framework Online Product Development, Review and Evaluation project has also served to provide evidence of challenges that act to constrain the achievement of the full potential of this design philosophy. Table 2 lists the challenges that have become evident through the progress of this project.

Challenge	Evidence and Implications
Granularity	The project has identified a number of difficulties and issues associated with the development of a functional definition for the concept of a learning object. The term means different things to different people and the lack of consistency in definition and description has proven to be limiting in terms of developing a common understanding and sense of application. In particular the notion of grain size and scope of learning objects is an area that requires immediate attention.
Learning Designs	The development of generic learning designs that support the use of learning objects has been both a support and a challenge for the project. It provides a challenge because it supports contemporary teaching approaches and encourages student-centred learning while teachers and students are predominantly proponents (and experts) in more conventional modes. The use of these design forms can act to discourage teachers whose preferred instructional formats are more in line with conventional than contemporary learning strategies.
Storage	The development of reusable learning objects is one phase in the project but developing a means to store the objects in repositories that can serve them represents perhaps a bigger challenge. Most institutions are comfortable with serving materials from local servers. They are perhaps less comfortable with serving the material of others or providing open access to other institutions to their own resources. Developing systems that encourage and support resource sharing is a challenge yet to be faced by most providers of online learning.
Discovery	The Web is a large place and the whole intention of reusable learning objects is to cut-down on the duplication of objects. But providing sound and reliable ways for others to discover learning objects that are available for reuse is yet to be achieved. Within the Web, it is impossible often to distinguish between proprietary resources and those that can be freely used and amended. As learning designs become more and more based on the use of reusable objects, there will be a growing need for systems that market and discover the available resources and provide some sense of their value and quality.
Sharing	Coupled with the need for discovery is also the need for some systems to be generated that can manage the resource sharing activities. Some resources cannot be provided free of charge. The best resources will cost money to develop and developers will need to recoup costs if they are to continue their developments. Automated systems will need to be developed that can track resource sharing and provide some efficient means of calculating and determining costs and managing the payment of such.

Table 2: Challenges to developing learning designs with reusable learning objects

At this stage in the Australian Flexible Learning Framework Online Product Development, Review and Evaluation project, the Project Managers are now exploring strategies associated with the storage and dissemination of the learning resources. At the current time the processes are providing the means for use and reuse of learning objects within the various discrete projects to support flexible use and customisation. The next big challenge for the project and its national body is to consider ways and means for the vast arrays of resource elements, learning objects, to be stored and accessed in a fashion which would make them usable between and beyond the immediate projects for which they were created. This is clearly a challenge which when solved will provide guidelines for the large-scale dissemination of many other sources of other reusable learning elements currently in Australian education hyperspace.

Implications for Practice

Most of the activities associated with designing online learning environments based on the principles of reusable learning objects are being reported by the developers of large projects. Within most institutions, there is growing awareness of these approaches but until now, there has been relatively little activity undertaken to ensure or guarantee that online learning settings are being designed in ways that promote flexible use of the learning resources. This paper has discussed the basic principles behind the design processes and provided examples of projects in the local setting where such initiatives are being undertaken.

The use of learning objects as a component of the design and development process of online learning settings provides a number of advantages which value add to the process. In the first instance the fragmentation of the development into objects provides strong incentives and supports for contemporary instructional design that focuses on the provision of authentic contexts and settings for learning. In the second instance, the process recognises and supports the reuse of learning materials, and creates opportunities for large-scale savings in both development times and costs. It is highly likely that the principles described in this paper will soon become common elements of online learning design and development at all levels.

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INTERACTION ONLINE: ABOVE AND BEYOND REQUIREMENTS OF ASSESSMENT

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Abstract

Today's literature is filled with new paradigms for learning, specifically in relation to the increasing adoption of computer-mediated techniques for interactive learning. In many cases, learning may now be enhanced through the experience of a shared online environment for critical discussion, knowledge building and the establishment of supportive social communities. Research data obtained from social science students at Southern Cross University over two semesters reveals students' perceptions of the importance of online discussion whether these are assessable or not. This paper presents some findings and explores the impact of the emergence of a student-centred social learning environment.

Keywords

interaction, assessment, student surveys, learning communities

Introduction

A great deal has now been written which confirms that assessment is the key to learning in traditional settings (Ramsden, 1992), termed the *de facto* curriculum in distance education contexts (Rowntree, 1977) and the driver of students' approaches to study (Morgan, 1993). In all forms of distance education today - print-based, mediated via video or tele-conference, or supplemented by computer-based communications - assessment tasks can be seen as the active components of study. Assignments provide learners with opportunities to discover whether or not they understand, if they are able to perform competently and demonstrate what they have learnt in their studies. Furthermore, the feedback and grades that assessors communicate to students serve to both teach and motivate (Thorpe, 1998).

In such a paradigm of learning through assessment, new innovations in teaching and learning are likely to be incorporated within the assessment scheme in order to be 'road-tested' through engagement by a critical mass of learners. We have seen this situation occurring within the online learning environment in higher education, where teachers are making various forms of online discussion mandatory in order to ensure some level of activity. In what is known as 'third generation distance education' (Nipper, 1989), it can be said that the online learning environment has extended the range of skills to be assessed, for example, collaboration between remote students, information literacy skills and web design. Furthermore, opportunities to explore new assessment methods and styles are now afforded by, for example, ICQs, timed online exams, group projects, international collaboration, peer- and self-assessment (O'Reilly & Morgan, 1999). All these developments serve to blur the distinctions between on-campus and off-campus learning while strengthening the notion that students wherever they are, work primarily for grades.

Without attempting to debunk the clearly supported notion that assessment is critical to learning, this paper explores recent evidence from online teaching and learning experiences which indicates that online communication among learners has other intrinsic spin-offs. This paper will discuss the social experiences in construction of knowledge as well as the emergence of both social and knowledge communities online.

Motivators for Discussion

Recent discussions on the *eModerators List* (Berge & Collins, 2001) have debated whether giving credit is indeed the only way to ensure students engage in web-based discussion forums. To the question "Do they need marks to participate?" (Malcolm 2001), 24 answers were posted. Each respondent, confirmed the necessity to assess students in order to achieve 'engagement' and 'participation'. One participant of the list (Hart, 2001) states:

> People I find are BUSY– everyone I know uses ALL of their 24 hours per day. Every bit of time spent on a discussion board could be spent otherwise. If there is no credit for doing so, it is rational to spend time doing things that count more [emphasis in original].

This is reminiscent of the work by Lockwood (1992) who investigated the costs and benefits for open and distance learners when it came to optional learning activities in print-based study packages. Lockwood's findings were much the same as those reflected in the above comment that students weigh up what they can afford in terms of 'course-focus', 'self-focus' or 'assignment-focus'. Time and attention to study are allocated in the most pragmatic ways in order to satisfy both intrinsic and extrinsic requirements.

Now that many of the students in our programs have had previous experiences of online participation, we wonder about the decisions they are making in terms of benefits of online discussion irrespective of whether or not they are being assessed. At this time there is a range of assessment options being implemented in the School of Social & Workplace Development (SaWD) at Southern Cross University, including units with no compulsory graded online assessment tasks, or one compulsory online task plus encouragement for online participation, or compulsory graded weekly online activities. The surveys we conducted reveal something of the students' attitudes to the social and communal aspects of being within an online group in these units.

Collaborative Evaluation Research

After three years of design, development and delivery of web-based teaching in a wide range of approaches, SaWD academic staff have gained significant expertise in pedagogically sound course design. In addition to ongoing collaboration with educational design staff from the Teaching and Learning Centre (TLC) on approaches to teaching, learning and assessment online, SaWD staff have recently begun a series of evaluation projects to further inform their teaching practices. This paper reports some of the latest findings from surveys conducted by SaWD with input from TLC in respect of discussion and interaction occurring online.

Action Learning Methodology

The ongoing and iterative nature of course design comfortably lends itself to a cyclic and developmental approach to research and development as facilitated by action learning methods (Dick, 1997). To ensure that online units are responsive to learners' needs and that staff development benefits are maximised, SaWD staff with some input from TLC, collectively embarked upon a series of action learning cycles to capture the essence of their teaching and professional development experiences first hand.

Though initially focusing on an action research staff development model for online design (Ellis & Phelps, 2000), most recently the focus for action learning has included an investigation of the students' responses to the online learning experience. There is a need to understand the way students are using the online medium and the processes that are enhancing their learning. In 1995, Bates (p. 202) clearly stated:

> It is still open to debate whether this technology [computer-mediated communication] will result in truly new paradigms, or merely allow valued old paradigms to be used more effectively for learners at a distance.

The purpose of obtaining student feedback from SaWD students was therefore not so much to search for proof of the School's achievements in integrating computer-mediated communications into its programs, but to gain information which would help to initiate and continue improvements in interactive online teaching and learning. We sought to investigate whether students' online communications were telling us more about a peer-based social context for learning than we might have assumed, given the extensive literature on importance of assessment and tutor feedback (Thorpe, 1998).

Two online surveys were conducted with students – late in semester 2, 2000 and early in semester 1, 2001. The aim of these surveys was to gather feedback from students on their perceptions of features that were aiding or distracting from their learning in the online environment, more specifically the relevance of online discussion features for learning.

Timely analysis of the data from the first survey has allowed immediate fine-tuning of unit design and the implementation of student support mechanisms (Newton & Ledgerwood, 2001) as well as enabling a responsive approach by teaching staff to improve their pedagogical strategies. The latter activities have particularly occurred in relation to the design and expectations of students' communication skills, levels and purpose of interaction. Subsequent cycles of information collection, reflection and implementation of change are continuing.

What are Students Communicating?

'Collaborative learning' is discussed in the literature as a process that involves interdependence and the progress towards shared goals (Palloff & Pratt, 1999). In this context we see the emergence of the concept of a learning community (Hill & Hall, 2001). These terms are useful in the general discussion of online communication as they focus more on the processes and purposes of online communication for students rather than just on the online medium that allows interaction to occur.

The terms 'interaction' and 'communication' have been used a little interchangeably in this paper. However, distinctions are made within the literature. In the broad sense of the word 'interaction' can be defined as including:

- learners' interaction with content in terms of the level of their critical thinking and critical reasoning skills and,
- learners' interaction with others in terms of negotiation of meaning and co-construction of knowledge in shared learning environments (Sringam & Greer, 2000, pp. 82-3).

The evaluation research reported here was particularly aimed at examining the interactive communication among students rather than viewing it as a one-way transfer of information. Educational design staff in the TLC were keen to discover outcomes from the designs for online interaction which have been used by SaWD over the past two semesters in order to defuse the kind of sentiment expressed by Villalba and Romiszowski (2000, p. 1111):

> It is a sobering thought that in all the centuries since the Gutemberg [sic] print technology facilitated the mass dissemination of text, we are still struggling with the issues of mediocre textbooks, instructional manuals that fail to instruct and communications (including on-line texts and hypertexts) that just do not communicate.

If, as we have observed, students are becoming more experienced in this learning environment, then the challenges and demands on staff need to also continue to adapt. New forms of social interaction afforded in the online context require new responses by teachers and learners alike. As Sims (1999, p. 309) highlights, it is important to include:

> … learner representatives in the design process, as they are a group who can verify the effectiveness of the interactive experience in terms of participation, engagement and learning outcomes.

Results

First Survey (Semester 2, 2000)

29 students of 49 enrolled in SaWD online units replied to the survey conducted in Semester 2, 2000 – 60% response rate. 72% indicated they were mature aged (over 25), 76% female. Overall 62% had no previous experience of online modes of study.

Second Survey (Semester 1, 2001)

The second survey was made available to all students with access to SaWD online units. The potential respondents in this survey included students enrolled online, or externally with online access, or internally enrolled students with online access. Such a diverse cohort reflects the move towards a mixed mode of delivery at Southern Cross University as lecturers explore relative advantages of the online medium to support learning. Sixty-one students over 14 SaWD units delivered online replied to the second survey representing a response rate of about 10% of all students who accessed a SaWD online unit by the end of Semester 2. The response rate for students relying solely on the online medium for learning would have been higher than 10% as the total possible respondents counted included all students who accessed an online unit, even only once, by the end of the Semester and who did not rely on unit online delivery. The administration system did not allow us to identify the total number of students who were enrolled in the mixed modes. Despite this low rate of return, the trends reported confirmed the findings of the first and the more detailed qualitative answers and supported trends revealed in the first survey, particularly the value of peer-peer interaction. These results also provide feedback for further survey questions.

Similarly to Survey 1 the students were predominantly mature-aged (83%), mostly female (73%), studying from homes outside metropolitan areas (67%), mostly inexperienced in online mode of learning (79%).

Overall the respondents enjoyed their unit with none reporting that they "Did not enjoy (the Unit) at all" and 48% (Survey 1) and 55% (Survey 2) reporting that they enjoyed the unit a "Great" or "Very Great" amount. Respondents expressed a high level of satisfaction with the online delivery mode with a preference for online delivery mode for the unit (79%, Survey 1) rather than a paper-based off-campus delivery. Only 7% (Survey 1) and 5% (Survey 2) reported that they would not take a further online unit. Table 1 shows students are reporting more competence in the use of online discussion tools.

Reported Competent With:	Survey 1	No. students	Survey 2	No. students
Word processing	100%	49	97%	59
Email	97%	48	90%	55
Internet browsers	94%	46	89%	54
Asynchronous discussion	45%	22	70%	43
Synchronous chat	28%	14	47%	29

Table 1: Percentage of students reporting an 'Average' or higher competence with online tools

Interaction

One of the most striking findings in both these surveys was the emphasis placed by students on peer-to-peer interaction. In the first survey, 82% students valued peer-to-peer interaction highly for learning, while 55% highly valued interaction with staff. Similarly, in the second survey 58% valued peer-to-peer interaction most highly for learning and 21% valued interaction with staff most highly.

Details of Interaction

Following the work of Sringam and Greer (2000), our second survey (2001) sought to ask students to make some distinctions between their activities within discussion forums at an individual level and their interactions in terms of working with other students. This 'work' was not restricted to assessable tasks (see Table 2).

Discussion Forums – Individual Use	
Haven't used	2.7%
Read the postings	27.7
Replied to a posting	28.7
New thread– started a new idea	18.1
New thread – asked a question	10.1
Activities for assignment	12.8

Table 2: Individual activities in the discussion forums

In terms of working with others, we asked students to give an indication of the specific nature of their interactions according to the selections provided as extracts from *the Cognitive Development and Interactive Analysis Model* (Sringam & Greer, 2000, p. 86), (see Table 3).

Discussion Forums – Working with Other Students	
Haven't worked with others	33.7%
Planning, organising	6.3
Encouraging others	16.8
Identifying disagreement	9.5
Clarifying meaning	16.8
Helping understanding	8.4
Summarising agreement	8.4

Table 3: Working with others in discussion forums

How Students Value Interaction

Overall there was very positive response to interaction in terms of social support and unit-focused learning support. The importance of social interaction was evident, in particular in forming friendships, offering advice, empathy and encouragement to continue studying in this new learning environment. Students who had previously studied via traditional paper-based distance education commented on the value of interaction for overcoming isolation and engaging in mutual support with peers. It was evident in Survey 2 that some students are becoming experienced online students and are developing expectations of a good online learning environment especially in their expectations for discussion and interaction with peers and lecturers. A sample of student comments from both surveys follow (with some students being concurrently enrolled in more than one subject):

Overcoming a sense of isolation was important for students' studying externally. In Survey 2 some students studying externally with some online access expressed the value of the online interaction for learning and a desire for studying online units in the future. A sense of becoming a part of a group was valued for learning:

- I have been an external student for the past four years. Even though I have attained pretty good grades learning on my own. I must admit that I really like on-line experience. It opens up new lines of thought and I can see some progress as I go.
- I wish I'd had it when I started 2 years ago. The discussion and chance to interact with other students is essential to know I am on the right track, and to get support and help.

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Specific comments on the value of interaction:

- We have formed a group to complete an assignment so we have had a fair bit of group interactivity.
- I think we interact wonderfully well and certainly online friendships are building.
- Excellent – everyone seems to use the online connection to work together and there is increased level of support.
- The experience has kept me motivated to continue and to get support from other students when I've come across difficult concepts in readings and study guides.

Their ideal learning situation includes support from online discussion:

- I appreciate the flexibility of the online unit and I feel that you actually get to know your lecturer better than if you were actually attending.
- The combination of paper study material and access to online contact with students and lecturers.

Respondents enjoyed the interaction with others as personal support when they experienced trouble with motivation or other personal problems:

- When I considered dropping out…my team encouraged me to take time out and they supported me through the worst part of my emotional turmoil. I learnt that the trust in our group is a very real part of us doing well.

Negative Comments about Interaction

Respondents disliked learning when there was less interaction with other students than they expected and when the instructions for use of the discussion forum or unit objectives were not clear. Feedback on the assessment tasks also suggests that too much compulsory discussion that is not structured or moderated is not liked by students. Compulsory online weekly assessed tasks were considered:

- Too much to do specifically each week.
- Too many comments to read and take in.

Some respondents initially felt uncomfortable with the technology, but found that the lecturers or other students could usually provide assistance in the first few weeks:

- I enjoyed the availability of the tips of other students regarding online tools.

Implementation Responses to Surveys

In response to the outcomes of both surveys, additions were made within the SaWD online learning environment by creating a Student Centre where additional help files were located to provide a central support resource area, and general unstructured support was encouraged among students. Subsequently, additional instructions were provided about using the discussion forums and downloading software required for some of the online features, such as Adobe Acrobat and Flash (Newton & Ledgerwood, 2001).

Feelings of frustration and low confidence were more evident in the beginning of the Semester in Survey 2 with students new to online learning having initial difficulty in using discussion forums and navigating around the units. However, there was evidence in the un-moderated Student Centre forums that students were overcoming these problems and assisting each other's progress, after a few weeks into the unit. Further induction instructions and a demonstration resource are planned in order to provide students with support to feel more capable and confident in the online environment.

Discussion

Mutual Support via Online Communication

Establishing a safe environment for learning through a perception of open communication where mutual and democratic support can be experienced, is one of the keys suggested in the building of communities online (Hill & Hall, 2001). Clearly the comments from students show that social interaction is considered an important element of being online, both to support learning and for mutual support of learners.

Laurillard's (1993) explanation of the importance of learning through a conversational framework can be reiterated from the results of this survey. However in addition, the results provided here by the social science students go towards emphasising the importance of peer-to-peer interaction for learning and not just the conversational framework occurring between student and teacher.

Disciplinary Relevance of Discussion

Evidence might further be sought on the importance of disciplinary practices and their effects upon students' level of participation in discussion online. Recent comments from educational design staff (Morgan, pers. comm. 13 June 2001) illustrate that in the area of humanities, where discursive approaches to learning are pivotal, previous practices of structuring assessable discussions have now ceased, due to the high uptake of student interaction in the online context. The level of active interaction in courses such as the humanities area and the social science area which we researched, can thus be related to both the relevance of the discipline as well as students becoming more experienced with using discussion as part of their learning activities.

Social Cohesion

Another key to consider is that of the social cohesion of the group assisting in the process of learning (Brandon & Hollingshead, 1999). Not only need the learners develop technical and social skills for the online environment, but also our students in Survey 2 were telling us of the online social context which they considered to improve their learning experience. However, the lack of traditional social elements such as physical appearances, tone of voice, linguistic habits, accents or impediments, have meant to these students that their formation of a network is based around mutual valuing of learning goals, without other distractions (Parry & Dunn, 2000).

The expression of shared goals (Thorpe, 1998; Palloff & Pratt, 2000; Hill & Hall, 2001) can be seen in the students' reports of encouraging others (as opposed to competing with each other), helping understanding and summarising agreement.

Social Constructivism

Social construction of knowledge has been discussed in many ways since Vygotsky's work on the effects of encountering the zone of proximal development through cooperative learning (in Doolittle, 1997), Piaget's theory of learning through multiple perspectives (in London, 1988), and cognitive-elaboration theory (Brandon & Hollingshead, 1999). These theories all provide clear support for the positive experience being reported by our social science students regarding the value of online interaction.

Research by Jiang and Ting (2000) showed that students felt their learning was enhanced when online discussion was a key feature of the course. What was interesting with our survey of social science students was that the students were initiating the social interaction themselves and seeing this as supporting their learning.

Benchmarking

Comments from students reflecting on their personal approaches to learning and up-skilling with the technologies, such as, 'We were all feeling the same anxiety about meeting deadlines and subject and assignment material', provide evidence of the importance of communication for the purpose of benchmarking. In particular in groups of students who are remote from each other, this benchmarking facility is highly important, 'fostering deep or meaning approaches to learning in online settings' (Parry & Dunn, 2000, p. 227).

Motivation, Confidence and Making New Friends

Harasim (1993) speaks most positively of the networked environment:

> As a technological innovation and a social construct, global networks impact the ways in which we communicate, with transformative implications for how we form community, how we work, and how we learn (p. 16).

Potentials described by Harasim (1993) for interaction on a vast range of subjects with both peers and experts from around the world are now clearly being realised, with the process of 'knowledge building' and 'information sharing' being seen as actively impacting upon most spheres of society. Note the number of online forums now available for following up on the guest speakers of TV and radio presentations.

Intrinsic motivation for engaging in online discussion is also evident from our social science students, many of whom stated the importance of gaining confidence in a safe (i.e. non-assessed) context, forming friendships online, and spontaneously offering suggestions and hints for handling what was for some a most unfamiliar environment. The idea of making new friends through online discussion has also been referred to in recent research by Baskin (in press) using Kirkpatrick's model to explore the effectiveness of collaborative online group work in the context of business studies.

Networked Intelligence

In his keynote address at the AusWeb01 Conference, Walter Stewart (2001) concluded his presentation with the message that the future of learning is not about networks, computers, courses, degrees and institutions… it's about networked intelligence. Phil Agre (2001), another keynote speaker of the conference talked of the wired university as an environment that promulgated social networks in a culture where knowledge is accepted as community property.

Conclusion

In conclusion, the surveys have helped confirm that the online social networks and online knowledge communities described by Stewart and Agre are an extension of our lives offline. Online students are taking advantage of the opportunities to interact, to form social networks that are contributing to a learning network. Gaining confidence and a sense of freedom in an unfamiliar learning environment is important for communication to develop. These social groups may be based on the enrolment in a unit and the need to achieve assessment tasks, but sharing understanding and supporting each other in an open unstructured forum suggests that deeper social and learning communication networks are developing among learners. In the online context we can expect that students will increasingly see the benefits to themselves of staying in-touch with others and shaping their own understanding. In addition, it has been inspiring to see that Jacobson's (1993) hopes for humanising the online environment are gradually coming to fruition, as learners demonstrate civility, conviviality, reciprocity, harmony, edification, artfulness and spirituality, above and beyond the requirements of their assignments.

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A REVIEW OF THE USE OF ONLINE SELF-ASSESSMENT MODULES TO ENHANCE STUDENT LEARNING OUTCOMES: ARE THEY WORTH THE EFFORT OF PRODUCTION?

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Abstract

Self-Assessment Modules or SAMs were first introduced into First Year Biology courses at the University of Sydney in 1996 to enable students to self-assess understanding of content and concepts in biology. The design incorporated four levels of difficulty, each of increasing cognitive complexity but designed to use the same content. The paper will describe the design of the SAMs and evaluation of their use and perceived usefulness over a three-year period.

Keywords

online, self-assessment, student learning, outcomes

Introduction

Courses with flexible structures, that offer choices to learners and provide for the development of self-directed learning, encourage students to develop a student-centred approach to their studies, to adopt deep learning strategies and to develop contextual appreciation of content (Candy, Crebert & O'Leary, 1994). It is recognised that feedback on performance is a valuable tool in the learning process, especially feedback of a formative nature that provides suitable opportunities for students to gain a personal insight into their understanding of course content (e.g. Zakrzewski & Bull, 1998; Macdonald, Mason & Heap, 1999). In addition the use of formative assessment prior to final tests has been shown to increase student performance in the final tests (Clariana, 1993; Zakrzewski & Bull, 1998). In the past early formative feedback was considered a normal component of science-based courses (as in the use of weekly quizzes, paper-based laboratory reports, solutions to questions, etc.) and much of it was followed up with face-to-face encounters between teachers and students. Currently with increasing student numbers and decreasing staff resources it is becoming more problematical to provide this essential resource. We, as teachers in the 21st century, need to come up with ways that help students help themselves and the issue of giving feedback to students needs to be revisited. One way to help solve some of these problems is the judicious use of self-assessment, particularly web-based, which for many teachers is a viable option that can provide valuable information for students about their progress (Butcher, Stefani & Tariq, 1995; Edwards, 1989; Stefani, 1994). This paper will look at a form of web-based self-assessment tool that is in use in large first year classes at the University of Sydney.

Design of Self-Assessment Modules (SAMs)

Our SAMs are designed to draw together related parts of a course to help students make connections between topics in biology and to promote a deeper learning strategy, whilst providing an enjoyable feedback and reinforcement session. They are additional, optional materials designed to let students identify their level of understanding. Whilst the courses are thematic, the SAMs are organised around specific content, thus students are taken down a lateral pathway and so encouraged to see the relationship between the materials. The development of SAMs in a non-course-specific way allows for their constant re-use even when the course themes change. The first SAM was designed and developed, using tailor-made templates, in 1996. Subsequent to this several SAMs have been produced each year, with content being entered into these question templates. Each SAM tests the student on four levels of increasing difficulty, using Bloom's taxonomy of educational objectives (Bloom, 1956) as the guide to develop the levels. Thus the content of the questions can be re-used (from level to level) but with an increasing cognitive requirement and appropriate question types have been developed for each level of difficulty. Level 1 tests *content and knowledge* with the use of multiple choice questions and drag and drop scenarios, but with the answer always on the screen. Level 2 tests *application* of content using some multiple choice, but mostly with a format that expects text input from the student. Level 3 tests *analysis* and uses question formats as for level 2, but with the addition of two part questions and formats requiring the building up of diagrams, flowcharts, etc. Level 4 tests *synthesis* of information, the most used format being free flow prose, where the student is expected to synthesise information in response to a question. This format is not computer-marked but marked by the student from sample answers, and with the option of self-scoring their own performance. A more detailed description of the educational design of the SAMs is contained in Peat (2000) and on the use of templates in their design from Peat and Franklin (1996). The SAMs appear online in a Virtual Learning Environment (VLE) that can be accessed on the Internet.

Student Instructions for Using a SAM

At the beginning of each SAM students are directed to a statement of educational rationale. Students are informed that each module is presented on four levels of difficulty and what each level is testing. As they finish each SAM, students are asked to think about their performance and compare it with a fictitious student – Mary Rotelearner – who learns content out of context and so performs well at the lower levels of difficulty and badly at the higher levels. In the log-out information students are encouraged to reflect on their performance at each level and to ask themselves what type of learning strategy they are adopting and whether it is appropriate.

Student Use of SAMs

The SAMs have been evaluated on an ongoing basis since their introduction in 1997, using both paper-based and online surveys, utilising both qualitative and quantitative methodology, and focus group discussions. Originally there was no intention to collect usage statistics from students, only formative evaluation information that would help us provide a more easily used product. Our emphasis was on student views about the product. However it is interesting to see the use of the SAMs within the bigger picture of use of our Virtual Learning Environment and this is reflected in Table 1.

Year	Used VLE	Used SAMs
1998	70%	41%
1999	94%	41%
2000(Semester 1)*	98%	-
2000(Semester 2)*	98%	60%
2000(S2)**Course 1	-	42%
2000(S2)***Course 2	-	85%

* email survey to 400 students chosen at random (25% response rate)

** paper-based survey to students in laboratory class time in Course 1

*** paper-based survey to students in laboratory class time in Course 2

Table 1: Usage figures for the VLE and SAMs (1998 – 2000)

There has been an increase in the usage of the VLE from 70% accessing it in 1998 to 98% accessing it in 2000; this is probably associated with both an increase in student access of the Internet and the provision of lecture notes on the Web through the VLE. Since their introduction in 1997, the percentage of students using the SAMs has gradually increased. In both 1998 and 1999, less than half the cohort of 1300 students (41%) had used the SAMs. By semester 2, 2000 this had increased to 60% of the cohort. Interestingly the usage varied between the two courses offered in semester 2, with an increased usage (85%) in one course but a decrease in usage (42%) in the other course. This difference in usage may reflect the way in which the SAMs are marketed (in lab notes, on the course website, by word of mouth), and the perceptions of their usefulness by students. There is no differentiation, in the data, between one-time users and repeated use by an individual. Students were asked if they had used the SAMs, not how many times and for how long, etc. When the SAMs were introduced it was decided not to build in any tracking.

An early paper-based survey in 1997 on how students were using the first SAM developed (i.e. the prototype) showed that most students using this type of resource did so alone and were not very likely to complete it (Table 2). More SAMs were introduced in 1998, 1999 and 2000 and it was decided to evaluate them electronically as the students logged out from each individual module and thus these data are from students who actually used the SAMs. Comparison across these three years, using these online surveys and asking the same questions for all SAMs, show a correlation with the 1997 preliminary data (Table 2). It is clear that the majority of students using the SAMs do so on their own, probably at home, they do not complete the entire module in one sitting and value being able to choose a level of difficulty when self-assessing. This is consistent with the design of this type of learning resource, in that it offers flexibility both for access and order of use, and that a student can quit from the module at any time during its use but still get formative feedback on performance. The data for 1998 and 1999 show the students did not enjoy the modules as much as in the other years and that they were even less likely to complete the module. During this time there were ongoing technological changes to delivery systems as more first year biology materials were being made available via the Internet which resulted in some teething problems associated with the downloading of some of the modules.

Year	Used alone	Used in a group	% completing the module	% enjoyed using the module	% like choosing level to do
1997	81%	19%	50%	100%	—
1998	96%	4%	26%	87%	96%
1999	99%	1%	22%	87%	94%
2000	96%	4%	45%	100%	96%

Table 2: How SAMs are used by students (1997 – 2000)

In 2000 the students were asked open-ended questions about how the SAMs helped them in their understanding of content, and their learning generally. There were 107 responses and, when categorised, help in revising, help in understanding the material and help in indicating the areas that need improvement rated most highly with 15% of the total responses for each. Giving feedback, offering useful diagrams and diagrammatic representation of ideas and being a different approach from the textbook rated 12% of the total responses for each.

In a structured set of survey questions, the students indicated that they found the SAMs useful to their understanding of the content (47% useful, 30% very useful/essential, on a 5-point Likert scale), and to helping them develop an independent approach to learning (34% useful, 42% very useful/essential). Comments from the students included: *"Make studying easier and a little more exciting"; "The interaction makes study ... more enjoyable"; "Explain the material in a different way to the textbook"*.

Two focus groups were asked, late in semester 2, about their use of SAMs. Those that had used them indicated that the SAMs had helped them to sort out detail in content areas where the textbook was not very useful and the lecturer had not given the detail but indicated it needed to be covered. Because the lower levels of a SAM focus on content, the students felt it helped them concentrate on the content and the linkages between the details of the content. Interestingly, most students indicated that they had used the SAMs firstly as a learning tool on the way through the semester and that they would be using them again as a self-assessment activity before the final examination.

Open-ended question methodology was used to ask students, who had not used the SAMs, the question "Why not?" The main reasons appear to be lack of time (29% of all responses) and lack of knowing the SAMs were available (27% of all responses). It is apparent to us that there is a need for better communication to the students about the types of resources available and the purpose of these resources.

A lot of time and money has been invested in the development of a learning aid that is being used by a considerable number of students (approximately 800 per year) and the data also indicate that the number using the resource is gradually increasing from year to year, supporting an argument to continue to offer these resources. The student reported use of the resources as a tutorial, to help understand and learn the content, adds to the argument.

We should address the lack of use by some students by more focused marketing (to students) and through staff training so that the teaching staff recommend the use of the resources at every relevant opportunity. However we need to ask the question "Is the lack of use due to poor communication or because there are (some) students for whom this type of learning opportunity does not suit their learning style?"

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STAFF AND STUDENT VIEWS OF THE USEFULNESS OF INFORMATION TECHNOLOGY MATERIALS WITHIN AN INTEGRATED CURRICULUM: ARE THESE EDUCATIONAL RESOURCES EFFECTIVE IN PROMOTING STUDENT LEARNING?

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Abstract

This paper reports on specific outcomes of a study on the perceived effectiveness of educational resources within the context of a single course in a first-year biology program. The overall study examined the dynamic state of perceptions towards all of these resources by the major stakeholders involved with the course (students, teaching staff and technical staff). A major focus of the research, reported here, was the extent to which the students used the computer-based resources made available to them, and staff and students' perceptions of the usefulness of these resources in supporting their learning.

Data were collected from the students using surveys and focus groups and from staff using surveys and interviews, within an action-research paradigm. While the majority of students found the resources to be of use in supporting learning, it is of interest that some did not find them useful and some did not use them at all. In comparison the staff had higher expectations of both usage and usefulness. The level of student use was not a function of access to computers or the Internet, so the findings suggest that the provision of online resources will not necessarily generate value-added learning.

Keywords
perceptions of IT use, student learning, biology education, online learning evaluation

Introduction

First year science courses at The University of Sydney have high enrolments, with students in many different degree programs in Science, Agriculture, Education, Arts and Engineering. This large group of students is very heterogeneous, characterised by varied educational and academic backgrounds with a broad range of incoming entry grades, and a range of incoming generic skills (writing, computer, team-work, etc.). Many of these students (not enrolled in specialist Science degrees) have a wide choice of subjects, which often means they are unsure of their future directions. In addition many students arrive at university with an expectation of being spoon-fed (McInnis, James, & McNaught, 1995), having been conditioned to using a surface approach to learning in high school, whereas at university they need to focus more on deep learning strategies to succeed within their chosen degree programs. It is recognised that active involvement in the learning scenario can lead to the use of deep learning strategies (Sutcliffe, Cogdell, Hansell & McAteer, 1999). Computer-based activities offer learning experiences that are under the control of the individual learner, that may better suit individual needs and offer active involvement by way of interactivity. Increasingly the Web is being used to create a better learning environment that is more independent of teacher interaction, is sustainable in the current economic climate and encourages the development of lifelong learning strategies. To provide this type of learning environment, the School of Biological Sciences at The University of Sydney set up a virtual learning environment (online), allowing students to access resources anywhere/ anytime. The development of this resource, and preliminary evaluations of its use by students, are discussed elsewhere (Peat, 2000a).

Within this Virtual Learning Environment (VLE) there are both communication and learning resources. The communication resources include both email access to staff and discussion fora, whilst the learning resources include online lecture notes, learning modules, self-assessment modules and links to useful websites.

There are three main types of learning module: interactive explorations, how to use equipment and generic skills development. The interactive explorations of biological topics are designed to be used in conjunction with paper-based materials, which contain a large amount of information at a variety of depths for students to explore in order to complete project and laboratory exercises. They enable biological processes to be illustrated in an animated manner that would otherwise not be available. Introductions to the use of specific equipment are designed to be completed before attending a laboratory class. The advantage of these modules is that after learning about the equipment, the student can "use" it to practice, before attending the class. Generic skills development modules train students in skills such as writing scientific reports. All the learning modules have quiz questions interspersed within the content and a section at the end so that students can further test themselves. Self-assessment online materials include specially designed Self-Assessment Modules (SAMs), self-test quizzes associated with each week's laboratory class and practice exams. SAMs enable students to self-assess their understanding of content and concepts, and incorporate four levels of difficulty each of increasing cognitive complexity and are additional optional materials (Peat, Franklin & Lewis, 2001). Many of the online resources are integrated within the curriculum and are required as pre-work to laboratory classes, learning materials within laboratory classes and as homework after a laboratory class. Other optional material is available is itemised for the students in their paper-based notes.

The current study examined one of the first year courses, Human Biology, which integrates a range of computer-based learning modules, online materials and communications strategies with more traditional learning resources such as lectures and practical sessions. It is recognised that the incorporation of information technology can change the roles of students and teachers, facilitate more student-centred learning and expand the scope and content of the curriculum (Horgan, 1998). Given the current environment, the learning paradigm is one where students are provided with a range of resources to cover the curriculum of the course and this range has been designed to cater for a variety of learning styles.

The purpose of this study was to provide both a reflective and analytical assessment of a broad range of learning resources integrated through web-based technology. An action research model was designed to collect data to enable assessment of the learning environment from all stakeholders. This approach was taken for three reasons. Firstly, the students constitute an heterogenous group with a large set of opinions regarding educational multimedia and communications technologies. Secondly, the educational multimedia resources used within this course have already been demonstrated as effective (Peat, 1999; 2000b; Peat, Franklin & Mackay-Wood, 1997). They have been developed over a number of years and formative evaluation has enabled enhancement of each resource as it was being integrated into the curriculum. In particular during this process, formative monitoring of the learning environment assessed (and improved) the functionality of the resources.

For this investigation it was considered more important to focus on the overall teaching and learning process rather than the effectiveness of individual resources. Thirdly, the research agenda within instructional technology has gone beyond that of comparing resources to one of making them work better (Reeves, 1999). Early meta analyses (e.g. Kulik & Kulik, 1986, 1991) reported significant gains for learners using computers compared with traditional learning resources. However, recent commentary questions whether this early research reflects any real gain (e.g. Stoll, 1996). For this project the focus was not on the individual resources as effective learning tools, but on the perceptions of both students and teaching staff as to their importance in the overall teaching and learning process; this is particularly significant with the increased emphasis by tertiary institutions on online learning and given the amount of time and money that had been spent on the development of all the teaching and learning resources. This paper examines the role of educational multimedia and communications technologies on the learning opportunities for a large group of first year students from the student and staff perspectives. The outcomes of the overall study will inform other curriculum developments within first year biology courses.

The Stakeholders

The stakeholders included students (n=up to 800), lecturers (n=5), laboratory teaching staff (n=20), technical staff (n=3), and courseware developers (n=2). The target population of students is typically recent high school leavers enrolled in science-based degree programs. The lecturers are responsible for their own lectures although they must follow a course outline and they may not all be involved in the laboratory teaching. The laboratory teaching staff form a diverse group, many of whom are casual, staff employed just for the laboratory sessions. Anecdotal evidence suggests that this group of staff (and maybe also the technical staff) have pre-conceived ideas aboutt the aims and outcomes of the course (in spite of written information detailing these issues) and they may not necessarily appreciate how the different learning resources can be used by students. The teaching staff were asked to keep encouraging students to use the online resources as the semester proceeded. Such encouragement was included in the weekly announcements for each laboratory class and emphasised by the class supervisor. Examining the alignment/ non-alignment of staff-student perceptions of the resources will allow any serious misalignment discrepancies to be addressed.

Methodology

The research model used was based on the more recent arguments of Reeves (1993) and Alexander and Hedberg (1994) which have led to a model involving a mixed approach to data production and analysis, with both quantitative and qualitative information obtained in the evaluation process. Described as the Eclectic-Mixed Methods-Pragmatic Paradigm (Phillips, Bain, McNaught, Rice & Tripp, 2000), this approach is considered more capable of handling the complexity of modern society and technology, with a focus on practical problems rather than on issues, whilst also acknowledging the weakness of current evaluation tools.

The overall study was based on the perceptions of the major stakeholders involved in the course; however, **this paper focuses on the laboratory teaching staff and students' perceptions** of the use of educational multimedia and communications technologies within an integrated curriculum. The overall data collections involved all stakeholders and data were collected at four separate intervals, using surveys, interviews and/or focus groups. Figure 1 represents the action research model used in this project and Table 1 identifies from which stakeholder group data was collected at each point. Student surveys were conducted at each of the data collection points (DC_1-DC_4). At S_1 all students were surveyed, during the fourteen laboratory sessions of the first week of the semester. Subsequent data collection by survey was of a subset of this stakeholder group with S_2, S_3 and S_4 each surveying half the total number of students but chosen at random. Laboratory teaching staff were surveyed, lecturers were interviewed, as were the technical staff and the courseware developers. Both qualitative and quantitative data were collected.

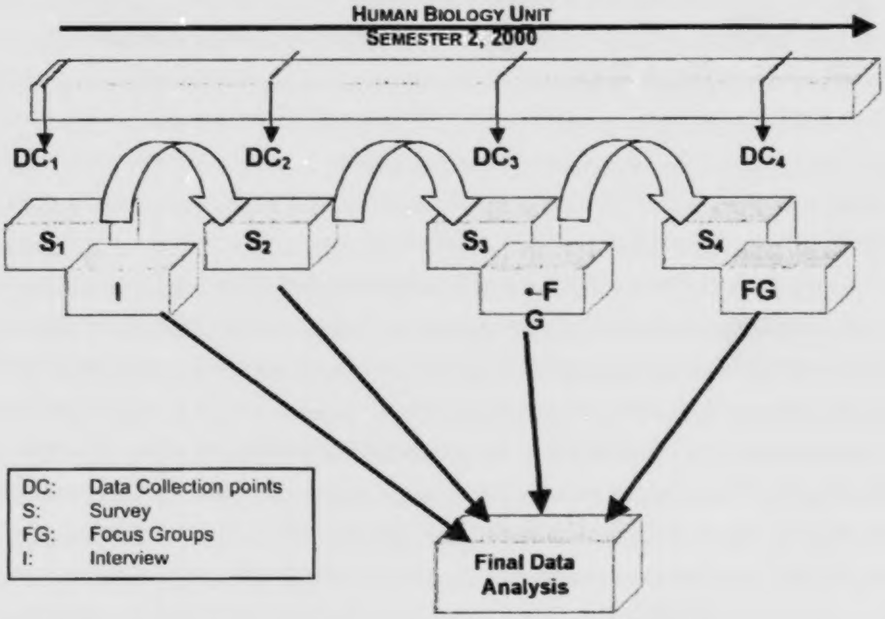

Figure 1. Project strategy

	Data Collection Points			
Stakeholders	**DC$_1$**	**DC$_2$**	**DC$_3$**	**DC$_4$**
Students	*S*	*S, FG*	*S*	*S, FG*
Laboratory teaching staff	*S*	-	-	*S*
Lecturers	I	-	-	-
Technical staff	I	-	-	-
Courseware developers	I	-	-	-

Table 1. Identification of data collection methods and stakeholders

The first data collection point (DC$_1$) was at the commencement of the course. This established a benchmark of both student understanding and perceptions prior to any teaching and learning influences and the other stakeholders' perceptions of the students. A separate instrument was designed for each of the stakeholder groups such that the questions focused on similar course delivery issues and all stakeholder perceptions of learning resources and how they would be used. This enabled the alignment of responses and the derivation of common themes in terms of the understanding, potential and use of learning resources within the course. It asked all stakeholders for their expectations of the use of different learning resources (including educational multimedia).

Whilst the data from each data collection point were used to inform the next survey or focus group and this has been described elsewhere (Franklin, Peat & Lewis, 2001), the comparison of staff and student perceptions relates to the data collected at DC$_1$ and DC$_4$. In addition, the demographic information provided from the first survey (S$_1$) has also been discussed in detail elsewhere (Peat *et al.*, 2001). The main information to note here is that 99.5% of students have access to a computer, with 98.5% of all students indicating access to the Internet (84% access at home). An interesting issue is that there is now significant competition within the home for the Internet line (36.5% of students indicating competition from siblings or parents).

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Results and Discussion

This section reports on the major factors emerging from this research process including:

- student use of computers and the Internet;
- student use of online materials in the Virtual Learning Environment;
- student views of communications technologies;
- students' perceptions about using online materials (tutorials, revision modules, self-assessment modules); and
- staff perceptions of the use students make of online resources and how they (the staff) rate the usefulness of these materials for student use.

Student Use of Computers and the Internet

The demographic analysis from S_1 indicates that students have good access to the Internet (98.5%); however, it was important to know whether the students used the Internet for their learning in Human Biology and if they perceived these resources useful to their learning, in order to justify the provision of these web-based first year biology resources. Similarly it was important to know what the staff perceptions were about students using the Internet to support learning. At the commencement of the semester, 54% of students expected it to be necessary to use a computer weekly, and 33% expected a daily need in order to participate in, and successfully complete, the Human Biology course (see Table 2). During the course 71% of students used a computer weekly for Human Biology and 13% accessed one daily (i.e. 84% used a computer at least weekly). The results were similar for Internet use as also shown in Table 2. Weekly use of a computer for human biology-related activities appeared to be sufficient. On the other hand the laboratory teaching staff thought that every student would use a computer and the Internet to support their learning (Table 2) and, in agreement with the students, that weekly use would be sufficient. This highlights that, as teaching staff, we automatically assume all students are using computers for course-related matters.

		Staff		Students	
		S_1	S_4	Expectation (S_1)	Actual (S_4)
Use of computer	never/rarely	0%	0%	13%	16%
	weekly	74%	91%	54%	71%
	daily	26%	9%	33%	13%
Use of Internet	never/rarely	0%	9%	11%	20%
	weekly	90%	73%	55%	64%
	daily	10%	18%	34%	16%

Table 2: Use of computers and the Internet to support learning

The fact that 16% of students never or rarely use a computer and 20% never or rarely use the Internet to support their learning in Human Biology is of great concern, as we provide a significant amount of computer-based learning resources, mostly accessed on the Internet.

Use of Biology Online Materials in the Virtual Learning Environment

The biology web-based resources, accessed via a Virtual Learning Environment (online), offer online lecture notes, educational multimedia materials and communications technologies; students are encouraged to use it as the principal website for the course. Thus it would be expected that there would be no difference between students' expectations of their use of the VLE to support their learning and their actual use, and this was found to be the case (Table 3), with 85% of students using the VLE. A few students (15%) did not actually use the VLE at all during the course, which corresponds to the 16% of students who, at the end of the semester, responded that they rarely or never accessed a computer to support their learning in Human Biology (Table 2). Students' perceptions of the usefulness of the VLE did not change over the semester, with 94% of students who used the resource perceiving it would be useful/ extremely useful and reporting it to

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be so (Table 4). This may be due to their experience of the VLE during the previous semester's course. However, the staff believe all students would have been using the VLE during the course, in particular to access the online lecture notes (just as they believe all students would use a computer at least weekly) when in fact the actual use of the VLE is less (85%). Again staff overestimated the usage of the VLE by the students to support their learning.

	Staff		**Students**	
	S_1	**S_4**	**Expectation (S_1)**	**Actual (S_4)**
Use of VLE to support learning	90%	100%	85%	85%
Usefulness (to those who used it) of VLE in supporting learning				
Not useful	0%	0%	6%	6%
Useful	61%	27%	47%	44%
Extremely useful	39%	73%	47%	50%

Table 3: Use of and perceptions of the usefulness of the biology virtual learning environment

Whilst general access to computers and the Internet is good, there is some concern within the student body about access to the educational multimedia materials made available via the VLE on the Internet for this course. A number of students (16%) indicated they had difficulties in accessing these materials and open-ended question methodology was used to find out why. In response to the question "Do you have any difficulties accessing First Year Biology Internet resources? If, yes, please indicate why?" there were 50 responses and these were categorised within themes. The major difficulties identified were difficulties with software (28% of all responses), insufficient RAM (22%) and download times (18%). The most frequently stated comment was about the difficulties with the "plugins" needed to view the educational multimedia modules online. The remaining 32% of responses covered competition for access, navigation and hardware problems.

We can provide the technology but we need to be careful that we match this with student abilities and experiences. Some universities provide all students with electronic toolkits to help them in using the Internet but this is only of use if the students are able to access the toolkit materials and use them. We are considering providing the students with our educational multimedia materials, with the appropriate plugins, on a CD.

Use and Perceptions of Communication Technologies

The facility for both chat groups and email were provided to students via the VLE. Web-based chat groups were initially not considered by many students to be a resource that they would use to support learning (16%) and in actual fact even fewer (5%) used chat groups during the semester to support their learning in Human Biology.

Email as a form of asynchronous communication, was considered to be a more useful resource to support learning in Human Biology. The student expectation of their probable use of email and its potential usefulness was, however, greater than the reality. At the commencement of the course 59% of students expected to have access to email at least weekly in order to participate in and successfully complete the course, whereas only 29% actually used email weekly (Table 4). In contrast the staff at the end of the course assumed that a much higher percentage of students (64%) would have used email at least weekly. Interestingly, 22% (about 160 students) initially expected to be in daily email contact but only 5% (40 students) actually used email daily, with the majority of students only using email weekly. Similarly 41% of students expected email to support their learning in Human Biology but in reality only 22% used it for this purpose. Of those 22% of students who used email, 57% found it useful/ extremely useful in supporting their learning. This means that approximately 10% of the entire cohort found email useful in supporting student learning (only 80 students).

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The fact that 71% of the entire cohort are never or rarely accessing email for course-related matters is of concern as we are currently sending email messages to all students via an electronic list, often on a weekly basis. These students are potentially missing out on important course information. However, whilst Table 4 reports on expectations of use (from S_1) and actual use (from S_4) of email to support learning in the Human Biology course, a mid-course survey (S_2) indicated that the overall student use of email was high, with 97% of all students surveyed indicating some use. Most of this use (75%) was for other than course-related activities. It should be noted that all students have been provided with a free email address by the University.

		Staff		Students	
		S_1	**S_4**	**Expectation (S_1)**	**Actual (S_4)**
Use of email	Never/rarely	16%	36%	41%	71%
	Weekly	48%	55%	37%	24%
	Daily	36%	9%	22%	5%
Usefulness (to those who used it) of Email in supporting learning					
	Not useful	22%	9%	41%	43%
	Useful	61%	82%	48%	47%
	Extremely useful	17%	9%	11%	10%
Use of Chat groups to support learning		42%	-	16%	5%

Table 4: Use of and perceptions of the usefulness of communication technologies in support of their learning

The student expectation for using email was much higher than the reality of using it and this needs to be viewed in the light of the other stakeholders' perceptions. The laboratory teaching staff expected a higher actual usage of email, and that email would be more useful in supporting student learning than students actually reported. Interestingly the initial high expectation of staff for email use by students (84%) had declined to 64% by the end of the semester, but was still much greater than the actual use of email (29%) by students. It may be that as teachers we have unrealistic expectations and that there is a mismatch between what we think as providers and how the students perceive the resources provided. It may be that the students, whilst expecting to use the technology, find they do not like using it or do not know how to use it and that these issues have not been addressed.

Student use of email was further investigated within focus group discussions where students indicated that they appreciated and expected information to be sent to them via email but that they would rather talk face-to-face with staff as this gives immediate feedback and allows for follow-up questions. Students found email responses to be "not fast enough", expecting immediate responses to their questions.

Use and Perceptions of Computer-based Online Resources

Since 1992 computer-based learning modules have been introduced into all the first year biology courses. In the human biology course there are many online materials available for the students to use: tutorials designed to be resources for students to use in conjunction with paper-based materials; pre-lab modules or introductions to the use of laboratory equipment; revision modules to review materials; and self-assessment modules allowing students to take a series of formative tests and exercises aimed at helping them monitor their level of understanding of major biological concepts.

Focusing on the online tutorials, at the start of the course students' expectation of the use of these resources was high (73%) (Table 5), matching their expectation of Internet use. Whilst a survey (S_2) during the course indicated their use to be relatively low (Franklin *et al.*, 2001), by the end of the course, computer-based tutorials had been used by 75% of the students (Table 6). There was no difference in the students' expectations of the use of computer-based tutorials and their actual final

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use to support their learning, although, again, the laboratory teaching staff expectations were higher than the students believing 91% of students would have been using them. There was a match of students' initial expectations (91%) of the usefulness of the computer-based tutorials with actual usefulness (91%). However, it is important to note that 25% of students did not use the computer-based tutorials to support their learning, and we need to investigate the reasons why. These results mirror the recent work of Oliver and Omari (2001) who found that 20% of students were not comfortable with using the Web as their learning environment and suggested that this number of students (50 in their cohort) is too big to be ignored when making decisions on delivery of materials.

The current study's data indicate that there are 200 students not using the educational multimedia materials. Given that 91% of those students that did use the materials found them useful, it is important to explore why this group of non-users do not avail themselves of these learning resources. They may be computer-phobic (although our anecdotal and survey data suggests that all students can use a computer) or it may be that this is not a good learning experience for them.

	Staff		**Students**	
	S_1	**S_4**	**Expectation (S_1)**	**Actual (S_4)**
Use of CBT to support learning	90%	100%	85%	85%
Usefulness (to those who used it) of CBT in supporting learning				
Not useful	0%	0%	9%	9%
Useful	66%	45%	60%	53%
Extremely useful	34%	55%	31%	38%

Table 5: Use of and perceptions of the usefulness of computer-based online tutorials (CBT)

Whilst in this current study we did not ask why students were not using online resources to support their learning, a smaller investigation targeting the use of one of the online resources, the self-assessment modules (SAMs), revealed the following reasons for non-use: lack of time (29% of all responses), not knowing they were available (27% of all responses), access problems (23% of all responses) and not motivated to use them (17% of all responses). The main reasons appear to be lack of time and lack of knowing the SAMs were available. This may also apply to the online resources in general.

Educational Implications

The message coming out of this study is that there are students who embrace educational multimedia and information and communications technologies and who will find these learning experiences valuable. However, there is fraction of the cohort (15-20% of 800 in the current study) that, for whatever reason, are not taking up the challenge of these new(er) technologies. Maybe there is a mismatch between us as providers of the resources and students as users of these resources. Questions yet to be explored include: "Did the students not like the resources?", "Were the resources hard to use?", "Are the resources perceived as core or additional?" and "What additional help is required to enable students to use the proffered materials?"

The staff who teach in these large first year courses need to be more informed of the characteristics of the student cohort. In all instances the staff expectations of students use of educational multimedia and information and communications technologies were higher than the students' expectations, highlighting a degree of misalignment between the two. Interestingly staff perceptions of the usage by students of the biology virtual learning environment and computer-based online tutorials increased as the course progressed, even though staff initial expectation was much higher than student actual usage (Tables 3 and 5). Staff need to understand that not all

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students will embrace the technologies offered and that if we require all our students to be using these technologies then we must be more sensitive towards those who appear to need more support.

It is important to evaluate the computer-based / Internet-based materials in the context of the curriculum and to remember that the student body requires a variety of learning experiences that not only embrace the electronic world but are also anchored in the more traditional offerings.

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THE ROLE OF METACOGNITIVE AND REFLECTIVE LEARNING PROCESSES IN DEVELOPING CAPABLE COMPUTER USERS

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Abstract

There is continued pressure for the application, and integration, of computer technologies into learning and teaching. For such innovations to be successfully implemented, students themselves must have the confidence, ability and willingness to engage with computer technology. In some disciplinary and professional contexts such as arts, humanities, social studies and education many adult learners are insecure and anxious regarding their ability to use, or to learn about, computer technology. Traditionally, competency-based, or skills-focussed training approaches have been utilised to assist inexperienced students to gain confidence with using computers. This paper argues that such approaches do not promote the development of individuals capable of life-long computer learning. What is lacking from such training contexts is a metacognitive dimension, which empowers learners to become more independent in their approach to learning with, and about, computers in the future. This paper discusses these issues and the potential role of metacognitive theory and reflective learning in re-conceptualising and re-designing computer end-user learning environments. Reference is made to a current research project, which is investigating the use of metacognitive and reflective learning approaches in developing capable computer users in one particular teacher education program.

Keywords

end-user computer education, metacognition, capability, reflection, 'expert learners', teacher education

Introduction

The annual conferences, and resultant proceedings, of the Australasian Society for Computers in Learning in Tertiary Education (ASCILITE) provide resounding evidence of the innovations being made in the application of computer technology in learning and teaching contexts. For such initiatives to be successful and well accepted, students undertaking study in these computer-mediated contexts need to be confident in their use of computers.

Surprisingly, little research or documentation exists that discusses the approaches which are taken to facilitate computer skills 'training', or the approaches which individuals take in their own learning. Even less literature documents the relationship between such 'training' or learning contexts and general computer confidence. Our experience would seem to suggest that in many organisational and tertiary contexts computer training programs are directive in nature, guiding participants through a series of step-by-step instructions. However, if one looks at the learning approaches adopted by experienced and confident computer users then it would seem that these individuals adopt quite different learning approaches compared to less experienced and less confident users. Firstly, most individuals who become adept at using computer technology learn experientially and, predominantly, through self-direction, rather than through short courses or training. If they do attend such training then they are unlikely to be concerned primarily with step-by-step instructions but rather with deriving broad conceptual understandings of the capacity and features of the software or hardware.

Information technology (IT) is developing at such a rapid rate that, if an individual undertakes training in how to use a particular piece of software, that knowledge is likely to be inadequate or out-of-date in a short period of time. This in itself presents significant challenges at the individual, organisational and social level. A relevant professional development program for IT requires more than skills training. It involves changes in attitude, values and beliefs (Lai, 1999, p. 16) that develop into the confidence for ongoing learning. Learning to use IT involves learning to adapt to change, to be flexible, intuitive and above all persistent! Learning through independent, hands-on experience and regular practice is vital and learners who know how to be self-directed and independent will be more successful than those dependent on structured guidelines (Ropp, 1998).

Directive teaching strategies that focus on providing directions to achieve certain specific outcomes (e.g. clicking on certain buttons) have their place. However, organisations and particularly higher education institutions also need to think strategically and sustainably about their teaching approaches, fostering self-directed and life-long learning. Such directive approaches may, in fact, fail to achieve long-term results if they reinforce dependency rather than independence. Organisations will increasingly feel the burden of ongoing training costs and will favour employees who are able to learn and adapt to new technologies without continual intensive training investment. Tertiary institutions will similarly receive pressure to foster such technological flexibility in their graduates.

How then can end-user learning and teaching environments assist individuals to develop life-long computer learning skills? In this paper one such approach will be explored. It involves a focus on reflection and metacognition (or metalearning). The paper will firstly provide a brief critique of competency-based approaches which have been widely adopted in IT contexts and contrast these to the notion of learning for 'capability'. A connection is drawn to the literature relating to metacognition and the 'expert learner'. The authors' current research is then discussed to illustrate how metacognitive learning approaches might be used to develop life-long capable computer users.

Computer Literacy and the Competency/ Capability Debate

The concept of computer literacy is an evolving one. Early literature emphasised the need for understanding hardware and programming (Higdon, 1995). At present the emphasis is application oriented, stressing skill development and competency in using particular programs (Oliver & Towers, 2000).

Competency-based training (CBT) approaches have been broadly implemented throughout the Australian Vocational Education and Training (VET) sector, and now compulsory education, sectors. Cornford (1997) suggests that this implementation has progressed with little rigorous evaluation or piloting and points to research highlighting its less than successful implementation. CBT emphasises pre-specified objectives and the achievement of clearly specified and measurable skill levels (Corben & Dunn, 1999). Competency-based assessment has been widely adopted in schools and vocational education in the area of information technology and can be seen as underpinning a range of organisational and tertiary 'training' contexts.

The notion of competency can be contrasted with that of capability. Cairns (2000) defines capability as "an all-round human quality, an integration of knowledge, skills and personal qualities used effectively and appropriately in response to varied, familiar and unfamiliar circumstances." Cairns continues that capability implies "...having justified confidence in your ability to take appropriate and effective action to formulate and solve problems in both familiar and unfamiliar and changing settings". A now strong body of literature supports discussion of the value of capability approaches to learning (Australian Capability Network, 1996; Bawden, 2000; Cairns, 1996a, 1996b, 1997; Hase, Cairns & Malloch, 1998; Limerick & Cunningham, 1993; Price, 1996; Royal Society for the Encouragement of Arts Manufactures and Commerce, 1996; Stephenson, 1996).

Capability approaches gain greatest value in contexts of rapid change (Australian Capability Network, 1996). Working effectively with computers and IT require creativity, intuition, confidence in managing learning and in an ability to perform. It is these qualities which are seen as contributing to 'capability'. Adaptability to change and an emphasis on life-long learning are aspects seen as deficient in competency-based initiatives. Wildman (1996) states that competencies suggest a "reductionist philosophy that relates to specific measurable behaviours... measured against a set of standards". He goes on to state that "competencies tend to be prescriptive and are designed for a more stable environment with familiar problems." Stephenson (1993) emphasised the importance of capability (as opposed to competencies) to technological contexts, stating that:

> Any society in which progress and change are common features requires its people to be independently capable. The speed of technological, economic and social change means our jobs and circumstances change more frequently and less predictably than before. The explosion in the expansion of specialist knowledge (doubling every eight years by one estimate), puts a premium on giving people confidence in their own ability to learn and shows how futile it is to try to sustain the formal transmission of knowledge model ... (p. 20-21)

These ideas all have relevance to the computer learning context, and support Loveless' (1995, p.xii) statement that computer capability is much more to do with an approach to learning and working than simply a set of technological skills.

Metacognition and the 'Expert Learner'

A connection can be drawn between the notion of 'capability' and that of the 'expert learner' as discussed by Ertmer and Newby (1996). By way of definition they state that expert learners "use the knowledge they have gained of themselves as learners, of task requirements, and of specific strategy use to deliberately select, control and monitor strategies needed to achieve desired learning goals" (Ertmer & Newby, 1996, p. 1). By way of further explanation they continue that:

> Expert learners notice when they are not learning and thus are likely to seek a strategic remedy when faced with learning difficulties... Novice learners, on the other hand, rarely reflect on their own performance and seldom evaluate or adjust their cognitive functioning to meet changing task demands or to correct unsuccessful performances (Ertmer & Newby, 1996, p. 6).

Expert learners are those who are aware of the knowledge and skills they do or do not possess and use appropriate strategies to actively implement or acquire them. They are thus self-directed and goal-oriented (Ertmer & Newby, 1996). Central to the notion of the 'expert learner' is metacognition. The term 'metacognition' appears to have emerged from the early work of Flavell who referred to it as knowledge concerning one's own cognitive processes and products or anything related to them (Flavell, 1976; Flavell, Miller & Miller, 1993). Biggs also discusses the role of metacognition in learning, utilising the term 'metalearning' to define the application of metacognition to student learning (Biggs, 1985). More particularly, Biggs defines metalearning as students' awareness of their learning and control over their strategy selection and deployment (Biggs, 1985, p. 192). The metalearner is one who is aware of their motives, task demands and personal cognitive resources and exert control over strategies used (Biggs, 1988, p. 127).

Ertmer and Newby (1996) claim that metacognition facilitates the strategic performance of expert learners and that reflection provides the critical link between knowledge and control of the learning process.

> As a powerful link between thought and action, reflection can supply information about outcomes and the effectiveness of selected strategies, thus making it possible for a learner to gain strategy knowledge from specific learning activities... Whereas metacognitive knowledge might be regarded as the 'static' knowledge one has accumulated regarding task, self and strategy variables... reflection is believed to be a more active process of exploring and discovering... (Ertmer & Newby, 1996, p. 14).

In their exploration of reflection, Ertmer and Newby extended Schön's (1983, 1987) notions of reflection *on* action and reflection *in* action to include reflection *for* action. Reflection *on* action is defined as the active process of making sense of past experiences for the purpose of orienting oneself for current and/or future thought and action. Reflection *in* action is managing the process of learning and constantly adjusting and changing as new information is assimilated. However, reflection *for* action is "... employing reflective thinking skills to evaluate the results of one's own learning efforts" (Ertmer & Newby, 1996, p. 18).

In contexts of rapid change, such as in computer contexts, expert or 'capable' learners' metacognitive strategies provide distinct advantages, and may in fact be more important than skills themselves; "When asked to deal with novel situations, the specific cognitive skills and learning strategies we have available become more critical than the limited content knowledge we may possess" (Ertmer & Newby, 1996, p. 7). Thus, teaching approaches which can assist students to become 'expert learners' are more likely to empower them for life-long learning in turbulent and rapidly changing contexts, such as those involving computer technology. It is thus proposed here that metacognitive teaching approaches might foster greater long term learning capability for computer end-user.

Computers and Teacher Education

Teachers have experienced increasing expectations to incorporate computer technology into their teaching (Russell & Bradley, 1997). They are expected to have a broad range of skills in a wide range of software and adapt these skills to a diverse set of classroom situations. Additional pressure stems from expectations that teachers model positive, self-efficacious attitudes to their students (Delcourt & Kinzie, 1993; Russell & Bradley, 1997). For many teachers the gap between perceived technological competence and learning to use computers in their teaching is often threatening and overwhelming (Ropp, 1998). Many have high computer anxiety and low computer self-efficacy, which is further exacerbated by the often strong computer skills of *some* of their students. Furthermore, given the isolated and independent nature of their work, if they encounter difficulties there is often very little assistance or support available (Becker, 1994).

Teachers thus need to develop adaptive computer skills, including an ability to learn from colleagues, support personnel and students (Rea, Hoger & Rooney, 1999) as well as a capacity to engage in self-directed and experiential learning.

The Research Context

In 1999 the principal author became involved with teaching a Unit designed to provide pre-service teacher education students with information technology skills. This Unit is a core in both the Bachelor of Education (Primary) and Diploma of Education (Secondary) degrees. The student base included a wide range of people, many without strong IT backgrounds or any significant interest in computing. Some students had rarely used a computer at all, while others were quite experienced.

As future teachers themselves it was critical that these students developed the ability to engage with new and emerging software and hardware in creative and imaginative ways. While there were certainly some core skills that might be considered essential for this group, these future teachers needed to be prepared for a changing and unknown future technological context.

This Unit and its student group thus provided an excellent opportunity to investigate ways of assisting individuals to develop sustainable and life-long learning approaches toward computers – in other words an opportunity for investigating methods of developing 'capable' computer users.

The remainder of this paper provides a background to, and results from, an action research project that is investigating the use of metacognitive teaching strategies in developing more 'capable' computer users.

The Research Approach: Challenging Learners through Metacognitive Reflection

Action research was seen as an appropriate methodology given its focus on change processes, participation and reflection. This paper focuses specifically on the second research cycle of the principal authors' research conducted in Semester 2, 2000 with a group of 179 students from the Bachelor of Education (Primary) and Diploma of Education (Secondary) degrees at Southern Cross University.

The Unit was designed within a reflective learning context and encompassed a wide range of learning and teaching opportunities, encouraging students to engage with, and reflect upon, different learning strategies. Students were required to keep a journal throughout the semester over which the Unit was delivered which documented their reflections. This journal data, with the permission of the students, informed the wider research project and shaped further refinement of the teaching approaches for the next intake of students.

The Unit is presented as a flexible learning resource incorporating a fully self-contained online learning resource supplemented with optional tutorials. A major component of the Unit is a "Thinking" Module where students are presented with a body of theory and literature surrounding computer use and are encouraged to reflect on their own cognitive approaches to computers and their past and present learning processes. The Unit introduces students to the notion of computer 'capability' and students are prompted to reflect on individuals who they would consider to be 'capable' and in particular what learning strategies these individuals employ. Other specific theories encompassed include social-cognitive theory (self-efficacy), attribution theory, Kolb's learning styles and the notion of 'play'. Social-cognitive and attribution theories were also presented through a self-assessment survey. Based on existing survey instruments this survey was used not simply to gather data from the students but to prompt their own reflection on the influences on their learning. Students completed this survey at the beginning of the semester and then used their responses to the survey as a source of reflection while learning more about the theories. Students were again asked to complete the survey at the completion of the Unit so that they might observe changes in their own self-efficacy and attribution, and so that pre- and post-semester data might be analysed.

Students were provided with maximum flexibility in terms of the learning approaches they could pursue and were encouraged to 'experiment' with a range of learning approaches. For instance, a different teaching approach was employed in each of the tutorial sessions and students were prompted to reflect on these approaches in terms of short and long term learning outcomes. Teaching approaches included observation (data projection), verbal directions, exploratory learning (play) and cognitive modelling. Additionally, students are encouraged to pursue individual and small group approaches in working with the self-directed learning resources.

It is beyond the scope of this paper to detail the full findings of the research thus far. Instead, one particular aspect of the data is explored: the reflections of students on the notion of the 'capable' computer user. This aspect is illustrative of the potential of metacognitive learning and teaching approaches in fostering computer capability. The final section of the paper identifies the perceived limitations of the approach and the consequent focus of subsequent action research cycles.

Identifying Capability and Appropriate Learning Strategies for Capability

Students were prompted to reflect on someone who they considered to be a 'proficient' or 'capable' computer user and then to consider what learning approaches these individuals employed. The intension here was that students would have the opportunity of identifying a role model for their learning and, through directed reflection as to the learning techniques employed by such individuals, realise that they too could adopt such strategies.

Student responses, as represented in the reflective journals, were analysed and themes were identified from the data using a Grounded Theory approach (Charmaz, 2000; Glaser & Strauss, 1967).

There was a surprising degree of consistency across the responses from students with a core set of characteristics being identified. These core characteristics can be summarised as follows:

- confident in their own skills and abilities;
- patient and persistent, determined and calm;
- risk taker, courage to experiment, try new things, not afraid to make mistakes;
- methodical/ logical thinker;
- enthusiastic and motivated, enjoy using computers, positive attitude, personal interest;
- technical knowledge;
- love of learning;
- constant use, deep immersion; and
- problem-solving abilities, deduction.

When asked to reflect on how these capable computer users learn students almost always cited such approaches as self-directed learning, experimentation, trial and error, exploring and 'playing around'.

Notably, all the identified core characteristics, with the exception of the sixth, are metacognitive constructs. The notion of 'technical knowledge', which might be considered as a self-evident characteristic of a capable computer user, was considered by many students as secondary to the more general traits which were viewed as leading to a *capacity* to develop technical knowledge.

It was evident from the data that a dichotomy existed between student responses. One portion of students were focussing on the 'technical infallibility' of the capable computer user. Another distinct group saw the capable computer user not as 'all knowing' in terms of technological skill, but rather able to employ appropriate learning approaches. Indicative of this second view was the following comment by one student who stated that "When I think of a good computer user I don't necessarily think of an expert. I think of someone who can quickly work through problematic situations even though they may not readily have the required skills". Students adopting a purely skills-based technological focus were in the minority.

The Potential Impact of the Metacognitive Approach

The potential of the metacognitive approach is best illustrated through the comments of students who came to the realisation that 'technical ability' was not, in itself, the central issue in computer use. One student, for instance, noted that "people's attitudes towards technology is their biggest enemy, rather than their lack of natural ability" and another stated that "confidence is the key. I believe anyone that has confidence in their ability can use computers effectively".

Many students took the opportunity to reflect on their own learning processes in relation to those of their identified model, as is illustrated in the following quote:

> My brother is truly amazing. For myself, if something doesn't work I might try it again once but the majority of the time I will just 'give up'. My brother sees these 'failures' as challenges to be met and conquered. He delights in the fact that he never has to stop learning because there will always be a new challenge to conquer. He loves the fact the information technology is such a dynamic field that it is always changing, improving and making new breakthroughs.

Through such reflection quite a number were able to pinpoint weaknesses in their own learning. For instance, one student identified their own lack of willingness or procrastination in learning as contrasting with their model's approach of learning "by doing". Another commented that "If something goes wrong when I am using the computer I freak out and panic, but when I see these people use the computer they seem to be able to work it out on their own. It is obvious to me that I learn differently to them when it comes to information technology".

Many students went on to challenge their own learning approaches and in the process developed greater confidence and independence. This is illustrated in the following student quote:

> I think the best way to tackle concepts and skills on the computer is definitely a trial and error process and to go from what you know and then delve into the unknown. The attitude you should take is one of curiosity and dive in and have a go. This is how most people I think solve problems they encounter on the computer, although a little knowledge in each area is a help but overall the willingness to have a go. Then to improve in each area is to actually take the time and play on the computer and the program you are actually working with. Throughout these nine weeks I think this is the most valuable aspect of computers I have actually learnt – have a go and you will learn things that you would never had known if someone had taught you.

Another student stated that "... developing an attitude towards computers that doesn't place too much importance about how skilful you are in their use has lead me to the position I'm in now that I don't feel pressured or anxious".

Most refreshing, however, was the capacity of many students to translate their own experiences and reflections into espoused values for teaching their own future students. This is illustrated in the following student's writing: "...as a result of this reflection, I can see not only the type of IT user I would like to become, but also the IT users I would like to create within my primary school classrooms". In this respect the metacognitive strategy can be seen as impacting not only on the adult learners involved but future young people potentially affected by the resultant strategies employed by these teacher education students.

While the process of reflective journaling seemed to provide a catalyst for insight and personal change for many students, there were a significant number of students who did not seem to benefit as much from the learning and teaching strategy.

For some students the metacognitive learning context raised internal awareness but did not necessarily lead to transformation. Such students may, for instance, have noted that capable computer users tended to adopt self-directed approaches to learning (including experimentation, trial and error, exploration and play) yet continued to indicate that they preferred, or sought, highly directive teaching contexts. For such students it seemed that an early insight had been gained however they were not developmentally ready to pursue such strategies themselves.

A greater limitation of the approach lay with individual students' capacity for reflection. Some journals simply did not evidence a level of reflection that provided students with an opening for transformation. This is not necessarily to say that these students did not experience reflective insights, but that their journals did not reflect this, either because of their lack of motivation and/or effort to write, or because of their lack of experience or capacity for reflective writing. For instance, students who indicated that the characteristics of a 'good' computer user were (solely) technical ability (as cited above) tended to be those who did not demonstrate a deep level of reflection throughout their journals.

A principle determinant, then, of the benefits of a metacognitive approach to computer end-user teaching and learning would appear to be the level and depth of reflective engagement by students.

Continuing the Research: The Search for Further Improvement

Further cycles of the action research project will refine these teaching approaches and explore methods to promote a greater depth of reflection and metacognitive engagement by students. Specifically, reflective small group discussion is being trialed as an alternative to written journal responses and a greater focus is being placed on self-analysis of motivation and goal setting.

Conclusion

Concepts of capability (as opposed to competency) and the construct of the 'expert learner' provide an innovative foundation for end-user computer education. Reflection and metacognition is central to the development of 'expert learners' and thus can potentially be seen to provide a sound framework for the development of 'capable' computer users.

The value of metacognitive approaches to end-user computer education is supported by the early findings of this research. In reflecting on their past and current learning approaches, and comparing themselves to a 'capable' computer role model students are more likely to challenge themselves to adopt learning approaches which are applicable for life-long learning. The factor which limits the success of this metacognitive approach most is the individual's capacity and motivation for reflection. Further research is aiming to refine the approach and determine if metacognitive teaching approaches can provide empowerment to a greater proportion of individuals.

This research has wider implications for tertiary education contexts, organisations and professional bodies. It suggests that careful consideration needs to be given to the type of computer 'training' being offered, particularly to individuals who might be considered to lack computer self-efficacy and who will need to continue to use computers in their profession and/or future careers. Competency-based and directive approaches may produce sound short-term outcomes, in the longer term may reinforce dependency of individuals on ongoing training. Metacognitively-based learning contexts may, however, represent a better long-term investment.

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A COMPARATIVE STUDY OF SOFTWARE TO AID THE DEVELOPMENT OF A CONCEPTUAL FRAMEWORK FOR INSTRUCTIONAL DESIGN THEORY

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Abstract

This paper examines the possibility of technology supporting and facilitating the organisation and development of knowledge in a particular field through critical discourse. Three examples of discourse-structuring technologies have been investigated to determine whether selected software might support critical discourse to capture the knowledge required to structure academic debate. It is envisaged that the technologies will provide a tool to aid the development of a conceptual framework for instructional design theory development.

Keywords

collective memory/ knowledge resource, distributed research communities, instructional design, online knowledge communities, ontology

Introduction

In the Information Age, the importance of being able to organize vast quantities of information and knowledge and be able to draw meaning from that knowledge is increasingly apparent. Information-rich institutions of higher education use technology for administrative management, information access and delivery in libraries, research and development, as a medium of communication, and for teaching and learning. Teaching and learning rely on the transfer, processing of, and reflection on information, and technology may facilitate this exchange. These technologies assume that the collective interpretation of an object or idea is invariably accomplished through discourse.

The authors of this paper are instructional designers at the Distance Education Centre, the University of Southern Queensland (USQ), and teachers of an online course, *Designing Instruction for Flexible Learning*. As with practising instructional designers, the learners in this online course are presented with various theories of instructional design and are required to analyse and to articulate viewpoints on theory, and to apply such theory to their own professional context. In the instructional design field, there are vast quantities of information and knowledge, not to mention various theories and points of view, and learners and practitioners need to be able to effectively manage this knowledge to draw meaning from that information. The study was instigated by the need to efficiently and effectively manage this knowledge.

Study Method

The authors explore why the use of computer technology might facilitate the organisation and development of knowledge in a particular field through discourse analysis. The authors then examine how this can be achieved by performing a comparative study to determine whether selected software might support critical discourse to capture the metaknowledge required to structure academic debate. This debate is often expressed only implicitly in publications, i.e., the author's challenge or support of an existing theory may not be stated explicitly. The long-term aim of the investigation is to find a means to facilitate co-construction of knowledge in order to achieve shared meaning and understanding, with a focus on instructional design theory.

Three examples of discourse-structuring technologies have been selected for comparison. The three examples are of systems for structuring interpretation-oriented discourse: sense making in meetings (QuestMap - Compendium), journal peer review (Digital Document Discourse Environment - D3E), and scholarly debate (ScholOnto). These technologies have been selected because the authors of this paper perceive that they may facilitate:

- collaborative learning and the development of learning communities;
- knowledge and discourse management; and
- the development of ontological frameworks;

and hence aid the development of a conceptual framework for instructional design theory development.

Collaborative Learning and the Development of a Learning Community

Collaborative learning is an educational 'buzz word', with writers using it to describe a variety of different learning situations. Roschelle and Teasley (1995, p. 70) defined collaboration as "a coordinated, synchronous activity that is the result of a continued attempt to construct and maintain a shared conception of a problem". Within the education framework, new standards are being defined based on a student-centred curriculum, increased interactive learning, integration of technology into the educational system, and collaborative study activities.

One of the key elements for successful collaborative learning is peer-to-peer sharing of experiences. Free-flow of information, ideas and advice from many participants is important for increasing exposure to different problem-solving approaches, different viewpoints and different spheres of knowledge, each of which enhances an individual's learning, adaptiveness and ability to recognise opportunities (Harasim *et al.*, 1995; Haythornthwaite, 1996). Only by requiring learners to demonstrate explicit comprehension, e.g. through activity and participating in online discourse, can teachers be sure that any deep understanding has occurred.

Knowledge and Discourse Management

Advances in technology have meant that there is now software available to facilitate and track written discourse in many contexts, e.g. meetings, scholarly debate and Internet communication. Internet technology can support the structuring of discourse, commonly in a threaded discussion, and provides a permanent record of the process. This record serves as a collective memory resource for subsequent reinterpretation. Making discourse structured and persistent changes the context and nature of that discourse—and such interventions must be introduced with care. Structuring makes explicit certain elements of the discourse that were previously implicit. Given these changes, a key challenge is to design the structuring technologies such that the changes enhance the discourse. As a consequence of the primary interaction to accomplish the immediate task, the software must also provide a scaffold for a structured, reusable memory resource for future use and users.

Development of an Ontological Framework

Motta, Buckingham Shum and Domingue (2000) discuss a number of technologies developed to support ontology-driven document enrichment and illustrate their ideas in the domains of electronic news publishing, scholarly discourse and medical guidelines. They note that animportant activity in knowledge management is 'to convert text to knowledge' (O'Leary, 1998). They use the term 'ontology' to indicate 'a specification of a reusable conceptualisation' (Motta, Buckingham

Shum & Domingue, in press, p. 2). Their approach is ontology-driven, in the sense that the construction of the knowledge model is carried out in a top-down fashion, by populating a given ontology rather than in a bottom-up fashion, by annotating a particular document (Gruber, 1993). More simply, an ontology can be seen as providing a representational scheme (a vocabulary) for describing a range of models. The ScholOnto software supports the development of ontologies.

Comparison of the Three Examples

The specific software examples (namely QuestMap, D3E, and ScholOnto) are now examined in detail.

QuestMap (Compendium)

QuestMap is a problem solving software (developed by Corporate Memory Systems, Inc. and later marketed by GDSS, Inc.). The key component of QuestMap is the use of a display system – much like one on an online whiteboard. The participating members of project team use QuestMap to capture the key issues and ideas during discussions and to create a shared understanding within a collaborative team environment (Selvin, 1999). All the messages, documents and reference material for a project can be placed on the 'whiteboard' and the relationships between them can be graphically displayed. Major corporations for strategic planning, environmental planning, business product re-engineering and new product design have used QuestMap.

QuestMap's origins lie in the problems faced by teams working over weeks or months to design business processes. The set of techniques which represent the approach revolve around a graphical hypermedia system for the development and application of:
(i) question-oriented templates, which serve as semiformal ontologies to structure the subject matter of a particular project (see Figure 1); and
(ii) a set of metadata tags that can be assigned to any concept in the database.

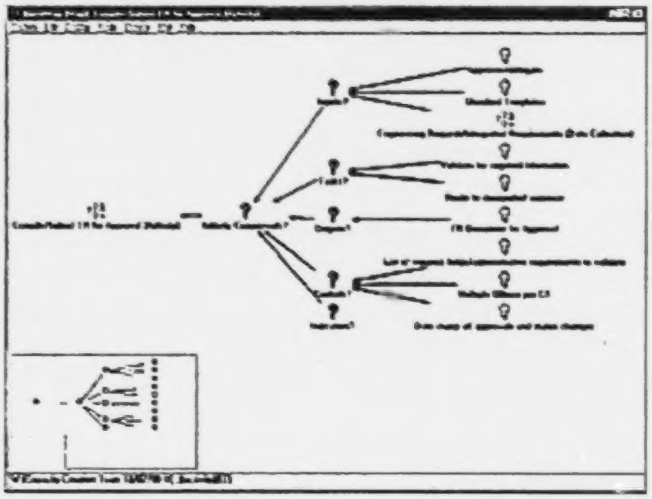

Figure 1: Example of a QuestMap question-oriented template (Selvin, 1999, Figure 4)

Digital Document Discourse Environment (D3E)

Digital Document Discourse Environment (D3E) (online) converts an HTML document into an environment with a user interface for navigating and discussing documents. D3E is currently freely available to academic and other non-profit making organisations, and collaborative partners of the software designers who are members of the Knowledge Media Institute (KMi), UK Open University team. The D3E software supports and documents online discussion of published literature, thus making explicit learners' discussion of ideas presented in the literature. The software has been used to

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create the Journal of Interactive Media in Education (JIME) which is a freely available peer reviewed, electronic journal (e-journal) targeted at researchers and practitioners interested in educational technology, both in school and workplace settings (JIME 1996). JIME articles are published in a web document-discussion user interface, which tightly links the article to an area for review comments and discussion. Reviewers can post comments under threads based on the journal's review criteria (e.g. originality of ideas), or they can make section-specific comments. The review process is designed to enable authors, reviewers and the wider community to engage in constructive discussion as opposed to the conventional anonymous issuing of a verdict. Once published readers use the software for critical discourse. Figure 2 illustrates this document interface.

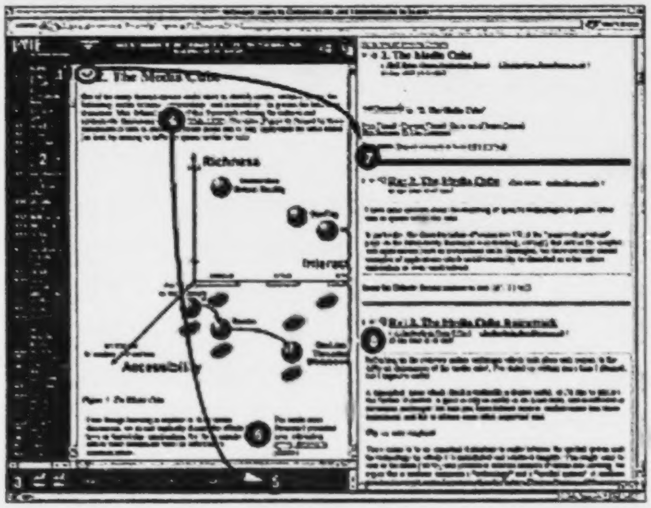

Figure 2: JIME document interface (Sumner & Buckingham Shum, 1998)

[1] Comment icon embedded in each section heading: clicking displays section-specific comments;
[2] active contents list extracted from the section headings;
[3] print versions as HTML and PDF;
[4] numeric or author/date citation automatically linked to corresponding reference in footnote window;
[5] a reverse hyperlink is inserted for each citation of a reference;
[6] an editorial note to draw attention to a controversial issue in the author-reviewer debate that 'made it' into the published version;
[7] section-specific review comment;
[8] an editorial comment summarising the review discussion and specifying change requirements.
(Note that there are two versions of the user interface: one as shown, and for smaller displays, the document and discussion are placed in separate browser windows.)

SchoIOnto

SchoIOnto, in beta phase at present, has the goal to devise new ways for distributed research communities to track and interpret their literatures. The Knowledge Media Institute (KMi) developers of SchoIOnto believe the web server architecture will enable research communities to publish and analyse their literatures in new ways through the creation of an evolving conceptual network of claims and debates. Because SchoIOnto is still under development, evaluation of the software is dependent on information presented in the literature. Developers of SchoIOnto are interested in:

- intellectual lineage of ideas: e.g. where has this come from, has it already been done?
- the impact of ideas: e.g. what reaction was there to this, has anyone built on it?

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- perspectives: are there distinctive schools of thought on this issue?
- inconsistencies: e.g. is an approach consistent with its espoused theoretical foundations?; is there contradictory evidence to a claim? and
- convergences: are different streams of research mutually reinforcing in interesting ways? (Buckingham Shum & Selvin, 2000, p. 5)

The ScholOnto project seeks to address the fundamental requirement for an ontology capable of supporting scholarly research communities in interpreting and discussing evolving ideas, overlaying *interpretations* of content, and supporting the emergence of (possibly conflicting) *perspectives*. The ScholOnto software provides an environment for scholars to make such claims in explicit, computer-readable form (whereas normally they remain implicit in a document's text, or undeclared). The types of claims specified within the ScholOnto software include 'support, similarity, causal, inference and taxonomic'. The goal is to provide a *summary* representation of ideas and their interconnections, in order to assist analysis of the ideas presented in the literature.

Motta *et al.* (in press) believe that this approach has advantages over textual media for tracing the intellectual lineage of a document's ideas, and for assessing the subsequent impact of those ideas—that is, how they have been challenged, supported and appropriated by others. ScholOnto has developed an ontology to support scholarly debate (see Figure 3) and once ScholOnto is released, the ontology will be used to characterise scholarly relations between documents. ScholOnto aims to be domain independent and useable by non-knowledge modellers. The authors of this paper are investigating the application of ScholOnto to create an instructional design ontology to inform discussion of theory and practice within the instructional design community.

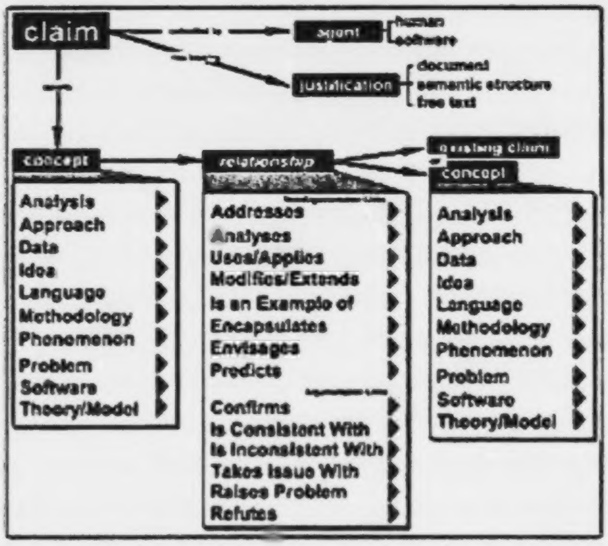
claim
agent
human
software
justification
document
semantic structure
free text
concept
relationship
existing claim
concept
Analysis
Approach
Data
Idea
Language
Methodology
Phenomenon
Problem
Software
Theory/Model
Addresses
Analyses
Uses/Applies
Modifies/Extends
Is an Example of
Encapsulates
Envisages
Predicts
Confirms
Is Consistent With
Is Inconsistent With
Takes Issue With
Raises Problem
Refutes
Analysis
Approach
Data
Idea
Language
Methodology
Phenomenon
Problem
Software
Theory/Model

Figure 3: The structure of a scholarly claim in an ontology

Results/ Findings

QuestMap was trialled at USQ to manage the discourse that emerged over a series of meetings held by a software implementation team. D3E was trialled briefly within an online course and later by several professionals in the instructional design field. As mentioned previously, ScholOnto is still in beta phase and trialling of this technology is underway. To assist in the selection of a suitable tool, Table 1 compares the three technologies focussing on the following attributes:

- the collective activities for which the programs provide support;
- the way in which they mediate and represent discourse;
- the manner in which they function as collective memory resources;

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- geographical spread of participants (same time/same place? etc.);
- participatory design and evolution of the discourse structuring scheme;
- facilitation/mediation;
- integration with existing practices;
- significant computational 'added value'; and
- integrations with existing technical infrastructure.

This table is an adaptation of several tables of information compiled by Buckingham Shum and Selvin (2000) and is also informed by the trials conducted by the authors.

Criteria	*QuestMap*	*D3E*	*ScholOnto*
Supports collective activities	• Visual sensemaking • Meeting facilitation • Project management	• Structured discussion of structured documents • Peer review and debate	• Research publishing and dissemination • Research debate • Literature analysis
Represents discourse as…	• Hypertexts rendered as concept maps	• Threaded discussion	• Knowledge-based semantic nets
Functions as a collective memory resource	• Expresses all stake-holder perspectives • Captures decision rationale • Traces documents to underlying motivations and assumptions • Hypertext linking • Visual landmarks	• Provides a document specific interpretative space • Preserves intellectual history of document	• Makes explicit a community's perceptions of a piece of work • Structures ongoing debates
Geographical spread	• Synchronously in meetings • Asynchronous via the Internet	• Asynchronous via the Internet	• Asynchronous via the Internet
Participatory design and evolution of the discourse structuring scheme	• Stakeholders can understand the visual mapping notation without explanation • Issue maps are created in real time for immediate verification and ownership of the record	• JIME's peer review discourse scheme has minimal formality and has not changed since journal launch • Other D3E applications have introduced new categories specific to the domain	• Core ontology will be refined following public releases and use • Research groups and communities will evolve their own extensions to the core ontology
Facilitation /mediation	• In a well understood domain, the facilitator's main role is to capture discourse in the tool	• JIME editors facilitate the review discussions and assist new editors in overseeing the review process	• Demonstrate the range of codification and discourse possibilities as communities begin to use the system, more experienced members will model possible uses
Integration with existing practices	• Used to augment teams addressing real problems • Imports from, and exports to established organizational notations and document types	• The conventional textual scholarly document is the central focus, plus familiar threaded discussion • JIME breaks from the traditional review model	Possibilities: • Integration with peer review processes (cf. JIME) • Integration with journal submission and publication • Integration into teaching contexts

Criteria	*QuestMap*	*D3E*	*ScholOnto*
Significant computational 'added value'	• Import/export from/to other documents • Reduces mundane conversion tasks	• Uses the Net to support scholarly debate in a reflective, but more timely, manner than possible in paper journals • Review debate on specific themes and sections is clustered together	Possibilities: • Knowledge-based services will assist in managing the discourse network • Semantic search agents • Semantic filtering • literature visualisations
Integrations with existing technical infrastructure	• Standard applications extended to translate to/from Compendium • Accessible over intra/internet Exports to website	• Accessed over the Net via a web browser, plus plugins for some interactive materials • Automatic HTML-conversions	• Accessed over the Net via a Web browser + Java applets Possibilities: • Email submission of documents for codification

Table 1: Comparison of discourse-oriented technologies for collective memory (adapted from: Buckingham, Shum & Selvin, 2000)

Discussion

QuestMap (Compendium) has been evolving since 1993 and is used in many business projects. It has specific application to a business context, but could be used for project management in any context. At USQ, the use of QuestMap to manage the discourse over a series of meetings of a software implementation team proved to be useful in terms of capturing key decision items and preventing time wasted in revisiting decisions made at previous meetings. The software also enabled quick information dispersal and exchange. However, the authors of this paper concluded that this software did not easily enable the level of critical discourse required for this particular exercise.

D3E uses a generic document-discussion interface and is used in many contexts by many groups. It has been used with JIME, which has been published since 1996 and continues to be used in this way. Use of this software by a number of instructional design professionals appeared to encourage focussed discourse on key issues in the literature selected for the study. Further investigation of this model is underway at USQ and it is envisaged that it will be utilised within a relaunched electronic journal, e-Jist (online). The results of this trial have encouraged the authors to implement the software within a course delivered only online at Masters level (*Designing Instruction for Flexible Learning*).

The ScholOnto project started in 1999. The modelling environment is in place and the literature modelling is underway. The success of software implementation of this kind in an educational environment relies on co-operation, or a 'willingness to share knowledge', either a basic work premise or is enforced by external constraints. Users must also gain personal benefit from the application of the software. For instance, academic analysis and publishing require scholars to read, refer to and praise/ criticise each other's work. The application of ScholOnto to document and make this process explicit clearly benefits academic discourse. However, this technology still is not in a format that can be easily applied and the authors are awaiting further developments before proceeding with practical implementation. It is anticipated that an example of the application of this technology will be available by the end of 2001.

The next stage of this study involves trialling the selected software programs further to determine the ability to capture the metaknowledge required to structure academic debate and support the authors' quest to find innovative approaches to sharing, accessing and understanding knowledge. This will then lead on to an exploratory investigation designed to gather information from an international group of instructional design professionals in terms of using the technology to facilitate critical analysis of academic discourse. Developing sophisticated, electronic tools is one matter, but implementing their use for communication between people is quite another. This may be the greatest challenge.

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THE INFLUENCE OF SUPPLEMENTARY MULTIMEDIA INSTRUCTION ON STUDENTS' KNOWLEDGE OF NORMAL SWALLOWING: AN AUTHENTIC INVESTIGATION OVER TIME

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Abstract

This paper describes the effect of supplementary multimedia instruction on the pattern of growth of student learning of normal swallowing. On four occasions up to 190 speech pathology students from four Australian universities completed a free-response task designed to assess students' learning of core information. Scripts were scored using a valid and reliable key. Hierarchical linear modelling was used to measure change in students' understanding over time. Within-student predictor variables included time, whether or not the student had used specific instructional technology and details of clinical practica, and between-student variables included site, grade point average, age, and gender. Students did improve following instruction and multimedia enhanced performance, with increased duration of use resulting in higher scores. Other influential variables were also determined, including site, gender and aptitude. The discussion of the findings addresses the implications for teaching.

Keywords

dysphagia, hierarchical linear modeling, information technology, student learning

Purpose

Over the past several decades there have been increasing expectations that information technology (IT) would "revolutionise higher education" (DEETYA, 1998, p. 59) and not only improve access but also enhance learning outcomes and reduce the costs of teaching, research and administration (Alexander, 1999). However, it is difficult to answer questions about the effectiveness of IT and results have been controversial. Indeed, the discussion is often impassioned (see, for example, Tripp, 1996; Reeves, 1996). Information technology is motivating (Atkins, 1993; Gunn, 1999) and time-efficient (Atkins, 1993; Oliver, 1998). There are many claims that IT enhances learning outcomes (Green & Gilbert, 1995; Tripp, 1996), and different media have been shown to affect learning in different ways (Furnham, Gunter & Green, 1988; Salomon, 1984). However, several studies have shown a lack of significant differences in learning outcomes when using IT (Clark & Craig, 1992; Clark & Solomon, 1986). It would appear that information technology can either help, confuse or confront students (Linn, 1992).

In spite of the difficulties with this body of research, there appears to be a range of learning activities that lend themselves well to IT, particularly when used to support the learning of conceptually difficult topics (Atkins, 1993; Clark, 1984). The swallowing process is a complex integrated sequence, largely hidden from view. An interactive multimedia program, *The Dynamic Swallow,* (Scholten & Russell, 2000a) was specifically designed to strengthen the student's core experience (Graves, 1989; Graves, Henshaw, Oberlin, & Parker, 1997) when learning about dysphagia (swallowing disorders).

Speech pathology students had been noted to have difficulty with fundamental issues related to normal swallowing. They appeared not to be well motivated to learn about normal functioning, and this inadequate preparation resulted in a lack of understanding of the complex issues around diagnosis and treatment. Interactive multimedia was chosen to address these limitations because of the ability to use multiple representations – text, graphics, animations, video and voiceover, to teach a hidden anatomic and physiological process. The selected learning design is interactive and uses simple simulations, in which users can deactivate certain aspects of the swallow and observe the effects of impairment, exploiting students' interest in disorder to help them learn about normal function. In addition, the program incorporates authentic diagnostic radiographic images, exposing users to aspects of professional practice at an early stage of their learning.

It is known that context is important to all learning, including that involving IT. Any evaluation of the influence of IT must account for the effects of individual differences among students with respect to factors such as aptitude, knowledge, skills, attitudes, previous experience and motivation (Reeves, 1992). The challenge is to employ sound strategies for assessing the impact of technology that are sensitive to the myriad features of interest (Gunn, 1999; Oliver, 1998; Reeves, 1992). The study design and analytic methods used in the present study ensure that such differences were largely accounted for. Authentic evaluations review the situation as a whole, rather than the effect of the resource alone (Oliver, 1998). The present study evaluates the contribution of this specific multimedia program to students' learning of the normal swallowing process in an authentic setting in which the CD-ROM was available for use as a supplementary learning resource.

Determining the effectiveness of educational innovation depends on accurate measurement of individual learning and investigation of the relationship between changes in learning and the educational practices. The correlates of growth are studied "to detect inter-individual differences in the growth parameters that are systematically related to some selected background characteristics of interest" (Willett, 1989, p. 413).

This paper extends earlier work that determined speech pathology students' knowledge of the normal swallowing process, concepts that are central to developing an adequate knowledge of dysphagia (Scholten, 2000; Scholten, Keeves & Lawson, *in press*). The paper reports on the growth in students' knowledge across four occasions that span the 15-week period of formal academic learning and into the following semester. It assesses the influence on such learning of factors associated with both the student and the instructional environment, with an emphasis on the use of multimedia enjoyed by students and determined by experts and teachers alike to be likely to contribute positively to learning (Scholten & Russell, 2000b). It is not only important to be able to describe the pattern of change but also to be able to provide reasons for any differences.

Method

One hundred and ninety undergraduate speech pathology students (183 females and 7 males) from four Australian universities participated in the study. On four occasions, 0) before commencement of lectures in the relevant topic (although after a topic covering basic anatomy and physiology); 1) immediately after the lecture(s) on normal swallowing; 2) on completion of the topic in which the relevant material was covered; and 3) two months later, students were asked to respond to the prompt: "*Describe the swallowing process in as much detail as possible*", a task that was completed in approximately ten minutes. Demographic information was also collected to enable multilevel analysis to be undertaken in an effort to learn about the influence of background characteristics. The within-student level predictor variables of interest included testing occasion (TIMEs 0, 1, 2 & 3), use of the program, *The Dynamic Swallow* (Scholten & Russell, 2000a), and observation of relevant clinical experiences (PRAC). The variables at the between-student level included university attended (SITEs 1, 2, 3 & 4), grade point average (GPA: 4.00-4.99; 5.00-5.99 and 6.00-6.99), AGE (under 25 or 25 and over) and GENDER. The scripts were collected by the respective teachers and returned to the investigator.

Scoring of Responses

Response scripts were collated and combined. Scripts were scored randomly by the investigator using a scoring key. Inter and intra-rater reliability had been established as above 0.87 (Scholten, Keeves & Lawson, *in press*). The quality of students' knowledge, as revealed in their written scripts, was assessed using the SOLO Taxonomy (Biggs & Collis, 1982). The scoring rubric evaluated 10 key features of swallowing, each of which received a score of 0, 1, 2 or 3, depending on the quality of the response (Scholten, Keeves & Lawson, *in press*). The partial credit model of Rasch analysis (Andrich, 1997) was employed to determine a hierarchy of feature difficulty and scale the scores. Scaled scores were normally distributed (mean = -1.47, standard deviation = 1.31; minimum = -5.45 and maximum = 1.92; kurtosis = -0.25 and skewness = -0.35).

Analysis

While a range of conventional analytical techniques such as ANOVA or MANOVA were available for the present analysis, they are not able to take into account the clustering of cases within groups (students at particular sites, generally known as the 'unit of analysis' problem). These techniques result in misleading estimates of significance and to false conclusions when applied to problems involving multilevel data structures (Goldstein, 1999, pp. 2-9).

The questions that arise in this study were answered with Hierarchical Linear Modelling (HLM) (Bryk & Raudenbush, 1992). Hierarchical Linear Modelling is able to describe the pattern of within-student change and the effects on that of between-student characteristics. Additionally, HLM can consider the interactive effects across these levels, overcoming the problems associated with conflation of individual and group effects. In this study changes over time in students' performance (within-student variation) and the influences of student characteristics (between-student variation) on performance formed two levels within the system being investigated. Students' Rasch scaled score on the test of knowledge of the normal swallowing process was the dependent variable.

Results

Data were available for a total of 190 third year students, but there was a considerable withdrawal from the study over time. Prior to the topic commencement 181 students took part, dropping to 160 participants immediately after instruction, with only 82 students remaining for the third and fourth occasions. Only 41 students completed the test on all four occasions. This dropout rate demands some explanation, as there may be systematic bias in the sample.

All available Australian speech pathology programs with a dysphagia topic agreed to participate in the study. (Two sites were excluded from final analysis). Consequently the sample is very representative of the target population. Over 80% of potential students agreed to participate initially, although it is acknowledged that there remains a level of self selection, as ethical requirements of research with human subjects does not permit compulsory participation. Even if one did coerce participation, there is no guarantee that such students' efforts would be indicative of their abilities. Although it is possible that weaker and less motivated students dropped out of the study, there is no reason to believe that this would have influenced the results generally.

Students' scores on each of the 10 key features of swallowing were summed to give a total out of 25 points. Figure 1 presents the overall mean response scores for each testing occasion (5.69 +/- 2.29; 10.16 +/- 3.04; 11.51 +/- 3.85; 10.61 +/- 3.29).

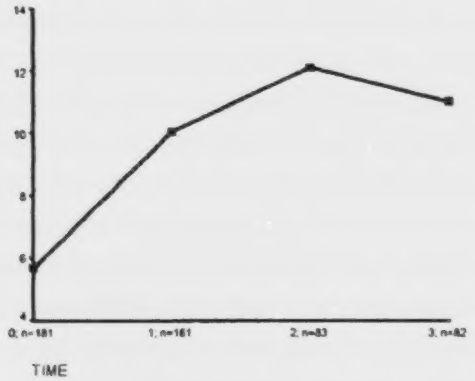

Figure 1: Overall mean response scores associated with each data collection point (TIME)

HLM Analysis

Students with two or more data points were included in the analysis. The data pool was further reduced to 151 cases because of difficulties with the administration of the test instrument at one site that resulted in some missing demographic data. However, the estimation procedures employed take into consideration the reliability of the data with respect to the number of time points involved. Hence, although the data pool is reduced from the total data available, the results obtained can be interpreted with confidence.

The analysis provides a reliable estimation of only three parameters for the effects of predictors at Level 1 because there are only four testing occasions, restricting the investigation to some degree. Consequently, a prudent approach was required in considering those variables which might offer the most sound explanation for change in student performance. Dummy dichotomous variables were constructed for SITE and TIME to facilitate examination of their influence on student learning. Because the effect over time was not linear (with testing occasions spaced differentially at the participants' institutions, depending on the structure of the topic and when the instruction took place) several additional dummy variables were created. These proxies for time were: INTER, which separated the first occasion from the others, reflecting the fact that at and after TIME 1 students had been exposed to intervention; DELAY, which separated TIMEs 0 and 1 from TIMEs 2 and 3, to capture the fact that some time had passed since the relevant lectures on normal swallowing; and INTOPIC, which separated TIMEs 0, 1 and 2 from TIME 3, to reflect the fact that the final testing occurred two months after the completion of the topic.

In the first step of analysis a sufficient statistics matrix was created (Bryk, Raudenbush & Congdon, 1996). The descriptive statistics generated in this way are presented in Table 1. The maximum number of iterations for the final analysis was set at 5000, but considerably fewer iterations were required for the successive steps involved in the analysis of the data.

Evolution of Models

The fully unconditional (null) model was calculated initially in order to partition variance into within and between-group components (see Table 4). This determines the variance explained as predictors are added to the model to reduce both the unexplained variance and the deviance. No predictors are included in the null model and any Level-1 or Level-2 effects are a consequence of only the error terms. The intra-class correlation was low (0.08), indicating that the variance between students was small in comparison with the within-student variance. That is, students were more like other students in their performance at any one time than when comparing their own performance over time. This is consistent with the notion that students' performance changed dramatically as they learned the material in question.

Level-1 Descriptive statistics N = 394					
	Code	**Mean**	**SD**	**Min.**	**Max.**
TIME	0, 1, 2, 3	1.09	1.05	0	3
CD	0, 1, 2, 3	0.44	0.84	0	3
PRAC	0, 1, 2	0.25	0.55	0	1
SCALED SCORE		-1.49	1.37	-5.45	1.92
INTER	0 1 1 1	0.64	0.48	0	1
INTOPIC	1 1 1 0	0.85	0.36	0	1
DELAY	0 0 1 1	0.30	0.46	0	1
Level-2 Descriptive statistics N = 151					
SITE 1	1 0 0 0	0.43	0.50	0	1
SITE 2	0 1 0 0	0.06	0.24	0	1
SITE 3	0 0 1 0	0.32	0.47	0	1
SITE 4	0 0 0 1	0.19	0.40	0	1
GPA		4.97	0.66	3.00	6.40
AGE		22	5.09	19	48
GENDER	0, 1	0.04	0.20	0	1

Table 1: Descriptive statistics for HLM analyses

The final model (or models) is arrived at successively by inserting variables of interest into the equations for both Levels 1 and 2 and conducting exploratory analyses to determine whether additional variables might enhance the model. The explanatory power of a model can be ascertained by calculating the variance explained and comparing this with that explained in the null model and by examining the change in deviance. The evolution of models in this study is summarised in Table 4, which depicts the variables included at Levels 1 and 2 for each model and provides values for sigma squared and the deviance which both help to evaluate the explanatory power of the model. The most powerful model is that with the lowest deviance. Because the design limitations of the study would not permit all variables of interest to be modelled simultaneously models related to key variables were calculated separately. That pertaining to use of IT is reported here.

Final Model: The Influence of Multimedia-based Supplementary Instruction

Because the effect of using the instructional CD-ROM, *The Dynamic Swallow* (Scholten & Russell, 2000a) was of particular interest this variable was modelled after key variables related to the effect of intervention and time had been explored. The variable INTER (intervention) was retained since it was shown to exert a strong influence on students' performance. In order to investigate the influence of IT, the variable CD was included at Level 1. Exploratory analysis had suggested that potential Level 2 predictors might include SITE 4, GENDER and GPA, which were included in this model.

Level-1 Model

$Y = B0 + B1 * (INTER) + B2 * (CD) + R$

Level-2 Model

$B0 = G00 + G01 * (SITE\ 4) + G02 * (GENDER) + G03 * (GPA) + U0$

$B1 = G10 + U1$

$B2 = G20 + U2$

Table 2 demonstrates that the inclusion of CD resulted in a somewhat better model than the majority of earlier ones (see Table 4). Variance explained at Level 1 has risen from 43 per cent in Model 1 to 68 per cent in the final model.

This model, summarised in Table 3, indicates that students' starting point, the intercept, is influenced by both their GPA and GENDER, with students having better academic records doing better than their peers and, interestingly, with male students outperforming the females when other factors are controlled. In addition, students from SITE 4 had an initial advantage compared with students from other sites. There is a strong effect (1.67) for intervention (INTER), with students benefiting significantly from instruction about the normal swallowing process. A smaller, but equally significant effect for CD use (0.22) is also observed. Students who use supplementary multimedia improve their scores. Critically, the more time that is spent with this form of learning, the better is students' performance, increasing by 0.22 units for each level of CD use (0, 1, 2 and 3), with no saturation effect detected. Exploratory analysis suggested that all students who used the CD improved, regardless of their opportunity for clinical observation, site, GPA, age, or gender.

This model could not be further specified and tested because only four time points were included in the data set.

Fixed Effect		**Coefficient**	**Standard Error**	**t -ratio**	***p* -value**
For INTERCEPT1, B0					
INTERCEPT2	G00	-4.36	0.52	-8.41	0.00
SITE 4	G01	0.52	0.15	3.50	0.00
GENDER	G02	0.55	0.14	3.90	0.00
GPA	G03	0.31	0.10	3.14	0.00
For INTER slope, B1					
INTERCEPT2	G10	1.67	0.09	18.19	0.00
For CD slope, B2					
INTERCEPT2	G20	0.22	0.06	3.43	0.00

Table 2: Fixed effects for the HLM Final Model

	Within-student Predictors	**Between-student Significant Predictors**
"Final" Model	**INTER, CD**	**B0 = SITE 4; GPA, GENDER**
	There was an overwhelming effect of instruction (INTER) for all students. The effect of using the CD was also positive, suggesting that students who used instructional multimedia in self-directed learning improved their scores, with a stronger effect with increased duration of use. The final model indicated that students' starting point was influenced by both their GPA and GENDER and that students from SITE 4 had an initial advantage.	

Table 3: Summary of Final Model

Model	**Level 1 Variables of interest**	**Level 2 Variables of interest**	**df**	**Sigma Squared**	**Deviance**
Null			**150**	**1.72**	**1364.62**
1	**TIME**		**150**	**0.99**	**1214.24**
2	**INTER, INTOPIC**		**150**	**0.58**	**1104.77**
2A	**INTER, DELAY**		**150**	**0.44**	**1094.51**
2B	**INTER, DELAY**	**B0 = SITE 3; SITE 4; GENDER; GPA**	**146**	**0.45**	**1061.27**
2C	**INTER, DELAY**	**B0 = SITE 4; GENDER; GPA** **B1 = SITE 4**	**147**	**0.45**	**1058.07**
2D	**INTER**	**B0 = SITE 4; GENDER; GPA** **B1 = SITE 4**	**147**	**0.58**	**1063.83**
***3**	**INTER, CD**	**B0 = SITE 4; GENDER; GPA**	**147**	**0.54**	**1060.00**

* Final Model. Grey type indicates non-significant variables of interest.

Table 4: Overview of models

Discussion

In this study changes over time in students' performance (within-student variation) and the influences of student characteristics (between-student variation) on performance formed two levels within the system being investigated. Variables of interest, with a focus here on the use of supplementary multimedia instruction, were modelled in a systematic process that investigated whether or not they contributed to a model that explained more of the residual variance.

Within-student Predictors

Influence of Intervention

The first stage of the study involved the investigation of changes in students' learning over time. The findings must be seen in the context of the initial Rasch analysis which highlighted those components of the swallowing process that students found easier to recall and those that were more difficult. Generally, students did not develop a deep and integrated understanding of the swallowing process (Scholten, 2000; Scholten, Keeves & Lawson, *in press*). However, it is encouraging to know that, despite the weak performance, intervention was a highly significant variable, with teaching clearly facilitating student learning without significant short term forgetting.

The second stage of the study helped to clarify those features that impacted upon the pattern of students' learning over time. The influence of IT operated at the within-student level over time (CD) and other variables focused on differences between students (SITE, GPA, AGE and GENDER).

Impact of IT

Hierarchical linear modelling confirmed the belief that use of *The Dynamic Swallow* would exert a positive influence on student learning (Scholten & Russell, 2000b). Students who use the program for longer periods of time benefit more from this supplementary study than students who spend less time in this self-directed learning. It was not expected that there would be enduring effects on learning with limited exposure of 30 minutes or less, a factor confirmed by the study.

Whereas this study was designed to determine, amongst other goals, whether or not *The Dynamic Swallow* would result in improved learning outcomes, it is not possible to do more than speculate about the reasons for such findings. However, an evaluation of Australian commonwealth-funded IT projects (Alexander, McKenzie & Geissinger, 1998) articulated some of the factors that contribute to enhanced learning, some of which apply to *The Dynamic Swallow*, as confirmed by evaluation of the program (Scholten & Russell, 2000).

One possible reason for improved learning following use of the CD-ROM relates to the likelihood of improved attitudes to learning the particular content. It had been previously determined that students enjoy using the CD (Scholten & Russell, 2000b) and there are links between motivation and high quality learning outcomes (Marton & Saljo, 1997; Prosser & Trigwell, 1998; Ramsden, 1992).

The Dynamic Swallow was designed to help students overcome particular weaknesses in core knowledge. The scoring key was sensitive to 10 underlying features and hence the demonstrated improvements in learning may reflect the value of the conceptual change strategies employed in the design of the program. The multiple representations of concepts, using text, graphics, animations, videos and voiceover, together with the interactivity associated with the program's simulations in which students could deactivate aspects of normal swallowing, appears to have resulted in improved construction and understanding of concepts, possibly related to an enhanced ability to visualise the internal system.

Increasingly, as the body of knowledge to be acquired by students expands, there is less class time available to teach particular content and appropriate material for self-directed learning would be valued by teachers. This CD was accessed individually by students outside of class time that may have increased time-on-task, enhancing understanding of lecture content. It is likely that the delivery format of learning materials resulted in relatively increased productivity of learning through the use of animations and video. The software design makes it easy for students to navigate throughout the learning resources, readily replaying or slowing videos and animations, checking definitions in the glossary and so on, all of which is more efficient than would be the case with more traditional resources.

Students may also have responded to the opportunities for autonomy around their own learning, learning in their own time, at their own pace and in an environment of their choosing. They were free to make mistakes, without embarrassment or dire consequences for patients. Because of this they may have felt liberated to try out ideas that might otherwise have gone untested, resulting in miscomprehension.

Finally, the inclusion of high quality graphic images, including diagnostic radiography used in clinical practice, in order to highlight the links between features of interest (disordered swallowing) to those that would otherwise have appeared dry and uninteresting, may have improved perceptions related to the relevance of the normal swallow, with resultant increased motivation.

The disparate CD-ROM uptake of between 4 and 67 per cent at various sites is of concern considering the demonstrated positive effect of this form of supplementary instruction. Some teachers are better at assimilating IT than others and it is possible that this resource may need to be integrated into courses more effectively in order for its true potential to be realised. In view of the poor uptake at some sites and in recognition of the fact that teachers may not be familiar with the potential of the program, a teacher's guide has been added to *The Dynamic Swallow*. The guide includes ideas for integrating the program within the entire learning experience in the topic, including normal swallowing, disorders and treatment and incorporating assessment tasks and classroom activities. Students need support when experiencing new activities (Alexander, McKenzie & Geissinger, 1998) and preparatory activities have recently been designed to help teachers introduce the program to students. This support and guidance is especially necessary for the students who have poor computer literacy skills.

A robust statistical effect has demonstrated that *The Dynamic Swallow* enhances student learning, with increased duration of use resulting in improved learning outcomes, and with no saturation effect demonstrated. The reasons for this promotion of learning must be unpacked in a future study designed to look specifically at this program.

Influence of Between-student Variables: Site, Aptitude & Gender

Reasons for the improved performance of students from SITE 4 can also only be speculative. Future research aimed at revealing the contributing factors to better performance may provide the key to improving learning of this important content area, with possible implications for learning more broadly.

The effect of prior aptitude (GPA) is not surprising. However, high ability students' knowledge did not grow at a greater rate than did others, suggesting that with increased resources, including time on task, weaker students could also achieve similar results.

A surprising finding of the present study is the significant relative advantage for this material experienced by male students. There were no outliers to account for this phenomenon and these men were not in the group of highest ranked students. This male benefit might relate to the nature of the knowledge content. The small male advantage in spatial performance has been well-studied because of the implications for mathematics and science education (Berk, 1991). It could be argued that appreciating the normal swallow demands the ability to develop an internal visual model of the entire process, which is highly integrated and involves continually changing spatial, pressure and flow relationships, features that commonly arise in the traditionally male domain of mechanical engineering. The very low numbers of males in this study demands that these findings are interpreted with caution.

In summary, this authentic study has clarified that intervention and use of the CD-ROM, *The Dynamic Swallow*, significantly influence student learning about normal swallowing. Students' aptitude and gender significantly influence students' starting scores, as does being at SITE 4. Finally, there is an interaction between SITE 4 and intervention that is noted in some of the final models, with students at SITE 4 learning more than their peers. There are immediate implications for dysphagia instruction but further research is required in order to determine the reasons for improved performance for students using the CD and those at SITE 4.

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vGALLERY SCAFFOLDING REFLECTION IN ACTION FOR STUDENTS AND TEACHERS

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Abstract

vGallery is an online exhibition, assessment and feedback system which can be configured to support confidential online evaluation. The contribution of vGallery to reflection in action derives from its ability to prompt and disclose the teacher's formative thinking about assessment and for students to self and peer assess on the same criteria, by applying the same standards. vGallery was developed during a CUTSD-funded project which has, over the past three years, explored the support that e-learning can provide to develop, support and evaluate higher order learning skills (specifically reflection in action) in early design students through digital delivery and digital making.

Keywords

reflection in action, online assessment, self-assessment, peer assessment, online evaluations, collaboration

Introduction

Reflection in action is an essential component of high quality learning experiences—a component identified as an essential graduate attribute (Boumelha, 2001). Our view is that *learning* is qualitatively distinct from *training*, and that teaching must be aligned with the achievement of deep learning approaches. As Biggs described 12 years ago, 'Teaching that gave evidence of deep learning contained in sharp form one or more of the following: an appropriate motivational context; a high degree of learner activity; interaction with others, both peers and teachers; a well-structured knowledge base.' (Biggs, 1989, p. 17)

Deep content learning occurs best when there is an intersection of motivational context, learner activity, interactive context, peer interaction, ownership (of learning and outcomes) and embedded teaching (Biggs, 1989, p. 19). Teaching practice that supports this alignment provides scaffolding for the development of reflection in early tertiary students using digital tools (Radford, Shannon, Mullins & Woodbury, 2001). We have developed vGallery as a tool to support collaborative and reflective learning that embodies these principles (Woodbury, Roberts & Shannon, 2000).

Appropriate Motivational Context for Reflection on Action

Reflection for learning builds on Schön's reflection in action: the process whereby the cycle of thinking, making, reflection, thinking, making and reflection iteratively conceives of a new design response to analysis and synthesis (Schön, 1983, p. 68). Our valuing of reflection for learning is informed by the framework of Biggs. His SOLO taxonomy for scaffolding higher order skills relates better learning outcomes to moving up the taxonomy from simple tasks of naming, memorisation, and learning procedures through to the higher order skills of reflection, hypothesis, generation, application to far domains and relating to principles (Biggs, 1999, p. 47).

Biggs associates deep learning outcomes with a teaching environment that uses teaching and assessment methods that support the explicit aims and objectives of the course (Biggs, 1999, pp. 16-17). Prosser and Trigwell (Prosser & Trigwell, 1999, p. 4) further associate deep learning outcomes with perceptions of a clear awareness of the goals and standards required in the subject. vGallery was developed to support reflection in action through making the goals and standards explicit.

Games Ensure a High Degree of Learner Activity and a Well Structured Knowledge Base

In those courses that are the subject of our CUTSD project, *Reflective Making: Higher Order Learning in Early Tertiary Architectural Education*, content has been distilled into a number of digital interactive exemplars that ensure active engagement. A current initiative within our School has been the reframing of student exercises as 'games'. Games develop and exploit the nature of play as a way of learning (Callois, 1961). The game provides a motivational context of intrinsic interest through active involvement in the planning and delivery of the game play and outcome (Woodbury, Shannon & Radford, 2001). The game is a reusable container exemplifying a process of analysing, evaluating and synthesising through engagement with content, peers and teachers.

Games are freely distributed using the worldwide web (AU, 2001), and games play outcomes are exhibited on the vGallery, (AUO, 2000). Assessment and evaluation capabilities have been added to vGallery to scaffold the development of higher order reflective learning for students.

vGallery Scaffolds Reflection through Interactive Content and Peer Interaction

While implementing Adelaide University assessment confidentiality policies, vGallery allows students to view online their own detailed feedback while generating collated assessment reports for the teacher/curator. As reported elsewhere, vGallery is an online exhibition, assessment and feedback system that enables many roles (Woodbury et al., 2000):

Teachers as curators are able to:

- configure the exhibition space to meet their pedagogical requirements;
- articulate assessment protocols including the enumeration of dimensions of assessment and their relative weighting using Likert scales (Mogey, 1999);
- allow/require students to reflect on their own and/or their peers' work as self or peer-assessors; and
- view peer, self & teacher critiques alongside the student's work and in collated form.

Students as exhibitors are able to:

- post their work via the World Wide Web;
- critique/reflect on work of their own or their peers using teacher-defined protocols; and
- access their confidential assessment online.

Assessors/ critics are able to:

- provide detailed confidential feedback within the protocols defined by the teacher.

As a result, vGallery presents interdependent opportunities to scaffold reflection.

The **teacher's**:

- professional thinking is revealed in planning the categories for criteria-based assessment;
- dimensions for completeness of a piece of assessable project work, (criteria), are established;
- holistic judgment is made explicit; and
- scoring against a Likert scale records the degree to which a piece of work has achieved the stated criteria.

The **student's**:

- self-judgement is fostered and tested for the extent to which they have succeeded in applying the criteria for assessment at a high standard to their own work on the same criteria and using the same standards as the teacher used; and

- assessment of a peer's work is exposed through the explicit application of established standards to established criteria as a tool in developing and applying self-judgement in a collaborative environment; just as

The **peer's**:

- assessment is received and compared to the teacher's judgement. This provides an opportunity to receive assessment in a collaborative environment where the teacher's judgment remains a referent.

In summary, **students' learning** is advantaged through opportunities to develop self-judgement, which is an essential element in the development of reflection in action, through:

- applying self-assessment utilising clear standards derived from the subject aims;
- applying established standards to their peer's work; and
- comparing their judgement with that of their peers and of the teacher.

Evaluation

The games and vGallery evaluation utilised a formative, summative and illuminative quantitative and qualitative methodology framework discussed by Oliver (Oliver, 2000). We have reported elsewhere on the preliminary findings concerning the effectiveness of games (Woodbury, Shannon & Sterk, 2001), vGallery (Woodbury et al., 2000) and the efficacy of the evaluation methodology (Shannon, 2001).

The evaluations reveal that different types of assessment contributed differently to students' learning. Whilst the *quantitative* evaluation is not significant that better students became more expert judges of their own, or their peers' work, than weaker students, when the teacher's judgement is used as a reference, *qualitative* evaluation reveals the contributions formative assessment plays in the students' learning to increase the likelihood of students becoming more accurate judges of their own and peers' designs.

The evaluations support the ability of vGallery formative assessment to contribute to scaffolding learning through making the assessment modes of the teacher, student and peer explicit (Prosser & Trigwell, 1999, p. 128). A vGallery confidential evaluation asked students to reflect on the differences between the information they gained from reflecting on teacher, and self-assessment.

What information did you gain from the teacher's assessment?

Student a The information gained from the assessment was very clear. The assessment criteria were outlined and I was able to also give myself an evaluation. The assessment was very useful, particularly for future projects, because it covered so many facets of the design task and the experiences created within each project.

Student b From the teacher's assessment, I can gain more information on the weakness that I have and the things that I am good in.

What understandings did you gain from completing your own self-assessment for the project?

Student c It let me compare the mark that I thought I should have got to the one allocated to me. This put me in the marker's place and a gained a greater understanding of the process that they undertake.

Student d I now know how it feels to assess work!!! It gives you a true reflection on work by having categories only directly concerned with the task and no 'bonus' areas. By completing the self-assessment, I was able to give more energy into the assessment dimensions, and realise the true purpose of the assignment.

What links can you see between the teacher's assessment, and your self-assessment?

Student e Susan is more in depth than I am, but we more or less thought the same things were lacking.

Student f Most links were very similar if not the same. This showed me that in many areas I was approaching the assignment in the correct way.

Conclusions

Our proposition from conducting illuminative evaluations in classrooms of early learners for three years is that students' reflection in action is a learned and modelled process: a skill, not a talent. It can be taught, and the teaching can be aligned with making teachers' judgements transparent, which of itself develops processes for fostering reflection in action for teachers. vGallery's enumeration and disclosure of the teacher's assessment categories and standards, and support for student's self and peer assessment online supports this process.

For students, scaffolding higher order skills of reflection in action is developed through their application of the clear goals and standards, enumerated and disclosed as criteria and standards on the vGallery assessment scales, to their own, and their peers' work, and through comparing their judgement with that of the teacher.

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Note

Since the completion of this paper, Robert Woodbury has been appointed the Professor of Information Technology and Interactive Arts at the Technical University of British Columbia.

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PROACTIVE EVALUATION: NEW PERSPECTIVES FOR ENSURING QUALITY IN ONLINE LEARNING APPLICATIONS

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Abstract

A major issue confronting educators is the extent to which they wish to conform to so-called paradigm shifts in teaching and learning. In the contemporary world of tertiary education these shifts embrace both pedagogy (from instructivist to constructivist) and technology (classroom to online). As teachers and learners are faced with the potential of these new learning environments, the extent to which the learning outcomes are achieved remains a high priority and subject to a wide range of evaluation strategies. Conventionally, evaluation is often conceptualised as occurring at the end of the development process, to assess first (formatively) whether or not the creative effort has achieved the original product goals and second (summatively) whether or not the desired learning outcomes were achieved. However, in the context of imperatives to implement online learning paradigms, the level of understanding teachers and developers have of the medium can impact the effectiveness of the product. This paper presents an additional perspective to the post-development, reactive evaluation processes in proposing the concept of proactive evaluation, a framework that identifies critical online learning factors and influences to better inform the development of learning resources. In essence, the proposal advocates an approach where development is undertaken within an environment where all activities are assessed using the evaluation criteria that would be applied when the product is assessed reactively. By performing these checks proactively, online learning resources will, in principle, work first time as all relevant factors and issues will have been considered and resolved.

Keywords
evaluation, online learning, educational design, quality assurance

Introduction

The imperative for tertiary education providers to embrace online learning as the primary mode for access to teaching and learning resources has never been greater. While many practitioners are familiar with the issues and processes associated with the production of these materials, institutions are demanding their creation without necessarily having staff competent in all aspects of the online paradigm. At the same time, research studies have demonstrated online environments to have both positive and negative impacts in terms of effectiveness and achievement of outcomes (Franklin, Peat, Lewis & Sims, 2001). Given this environment, it is critical that online development projects implement levels of quality control to ensure the learners receive the most effective resources. The most frequent form of quality assessment within the educational environment is that of evaluation, which is typically conducted at the end of the development process through formative and summative techniques. As a component of the educational development process, evaluation is also frequently discussed in the last chapter in textbooks (for example Smith & Ragan, 1999; Morrison, Ross & Kemp, 2001), reflecting a perceived position within the overall process. While critical for assessing quality and outcomes, this form of evaluation is often undertaken reactively, examining the functionality of the learning resources and the achievement of the associated learning objectives after the materials have been developed and implemented. The evaluation data thus collected can then be used to inform developments for and maintenance of those resources.

As an addition to this environment, and to provide specific support for the creation of online materials, this paper argues for a reconfigured development environment in which alternative elements of evaluation are integrated into all considerations of the design process. In concept, the production team are exhorted, through a proactive evaluation framework, to focus on the criteria by which their products and resources would be evaluated and thereby ensure that all factors associated with a successful evaluation are addressed during the design and development process. Theoretically, a product created using proactive evaluation will be more likely to achieve the educational and learning goals. More importantly, this paper is not suggesting a replacement of formative and summative evaluation protocols, as these are critical to the iterative nature of educational development. However, it is argued that the strategies proposed provide an integrated framework for an online pedagogy, and the proactive aspect places evaluation within all facets of the design, development and implementation process, as recommended by Sims (1997a).

Proactive Evaluation

The following classification of factors and associated influences provide the basis for a concept referred to as *proactive evaluation*. The essence of this concept is that by first considering the complex interactions between educational design and online environments, designers and developers with new or limited skills in online learning will reduce the risk of producing poor-quality or ineffective materials as well as the likelihood of critical, negative evaluation. The ideas presented can be viewed as an extension to current practice in instructional or learning design, as many of the factors identified stem from that theoretical base. However, the underlying principles assume that the environment for which the development is being undertaken is not a traditional instructional setting, but an online world in which the familiar relationships between teacher, learner and content no longer always hold true. By applying the proactive evaluation concept, development teams will not only ensure all aspects of creating online learning resources and activities are addressed, but that subsequent formative and summative evaluation will be more rigorous and meaningful. In addition, the concept focuses the decision making process on the complex interaction between disciplinary content, learning outcomes and computer-based learning environments. Better understanding and addressing these relationships will consistently produce more effective teaching and learning resources.

Strategic Intent

One of the first questions we always ask our clients is "Why are you attempting to place these resources or activities into an online context"? If they are unable to provide an explicit answer, then we argue that the strategic intent or rationale for the product has not been defined adequately. Without a clear understanding of the purpose of the product and the stakeholders who have an investment and/or interest in its outcomes, the chances of success are reduced. Within the tertiary education environment specifically, these stakeholders include the administration, the faculty, the development group and most importantly the students. Without full commitment to the concept from all stakeholders, even with the best intentions, effectiveness in terms of learning outcomes being achieved may not be realised.

The critical issue therefore is the extent to which the online component(s) being considered will add value to the teaching and learning process. For example, if an institution decides to "go online" without allocating sufficient funds to recreate materials so that they will be consistent with learner-computer communication, then the decision could prove extremely costly with few, if any, positive educational outcomes. Indeed, anecdotal feedback is suggesting a rebellion against online materials, such as the case where they are perceived by faculties as an economic solution to government cutbacks and workload increases. In other cases, where "online" has been introduced to reduce class contact time, student anger has resulted with resentment for being *short-changed*, not to mention issues of quality.

Content

Many online projects have focused on the conversion of existing paper-based resources into their digital equivalent, with a proliferation of unit outlines and study guides in either HTML or .PDF formats made available for student access. But this is not online learning, and if portrayed as such is a misrepresentation of the capabilities and benefits of the technology. If content materials and learning activities are to be placed online, then significant levels of thought must be placed on the very nature of the medium and the underlying implications for teaching and learning.

As represented by the content options identified in Table 1(a), the online environment caters for a range of content formats: from predetermined static elements to a more dynamic state where content is sourced, repurposed, constructed and enabled by and for all participants in the learning process. Between these two extremes are the more typical options for delivery of course content in terms of resource material being contributed to by both the teacher and the learner.

STATIC ◄---				►DYNAMIC
Predetermined and Presented	**Teacher Contributed**	**Learner Contributed**	**Captured Dialog (Interactivity)**	**Constructed**
Content defined and prescribed by the teacher, and does not change during the delivery cycle.	Content defined and prescribed, but additions or modifications made by teacher if and when required.	Content defined and prescribed, but learner additions and contributions enhance the resource base.	Through collaborative endeavours, content material is added to the overall resource base for the program.	Content defined through research by participants and subsequent interpretation and construction.

Table 1(a): Options affecting online content

To fully exploit the online environment means having to reassess the overall approach to the content, how it should be presented or accessed and the relationship between teacher and learner in that process. In addition, the options for unit or course content should be considered in terms of the interaction with the major design issues and their impact on the learning community. As detailed in Table 1(b), these issues have a significant impact on the presentation of the content and subject matter in the broader learning process. Implicit in this framework is the assumption that content can no longer be seen as being "owned" by the teacher or discipline, but rather as an information base that can be perceived and worked with in many different ways.

An illustration of the interplay between content creation and design parameters can be seen when an online environment enables learner-creation of content. While the information itself may be linked directly to the discipline, the environment enabling it to be created dynamically may conflict with accepted organisational or design standards. In developing online content the critical element of the process is to recognise this possibility and to be able to justify why specific decisions have been taken.

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COMPONENT	**Issues**
Structure Organisation & Information	If adopting strategies that enable the dynamic construction of knowledge, traditional forms of information presentation may have to be modified.
Matches Goals & Outcomes	The extent to which program goals and objectives are predefined may be affected by strategies that enable the learner to use knowledge construction techniques.
Contextual and/ or Situated	With a dispersed cohort of learners, content must be considered in terms of the context in which the learner is situated rather than that of the teacher's particular experience.
Information Accuracy, Integrity & Totality	Recognition of the learners' ability to contribute to the knowledge base presents questions as to accuracy and integrity – from whose perspective are these characteristics of the content to be measured and assessed?
Accessibility	A function of the technology (adaptable for handicapped users, uses appropriate plugins and bandwidth) but also includes accessibility in terms of appropriate language use (terminology, right level and even right language).
Extensibility of Content	Is the discipline base so rigid that no options for new content are considered possible, or can new alternatives be considered for collaboratively constructing and extending the knowledge base?
Quality of Expression (language, grammar, image resolution)	To what extent can traditional norms for quality of presentation be maintained if a more dynamic approach to content is considered appropriate, and what impact might this have on roles in the development process?

Table 1(b): Online content – Major components

Learning Design

The term *learning design* is used to emphasise the learner-centred environments online resources can provide. Taking this stance is particularly important because it forces designers to conceptualise the development process from the learner's perspective rather than that of the content. However this does not preclude developers from adopting an instructivist (I) or presentational strategy compared to a constructivist (C) or generative approach, but does require careful thinking about the learner and the options provided for interacting with the content and their learning partners. As shown in Table 2(a), the design of resources will be influenced by the pedagogy, outcome and resources considered appropriate for the task.

I ← Pedagogy → C	**Learning Outcome**	**Resources**
Individual teachers and learners have different philosophies on the most appropriate ways that knowledge is gained and learning acquired. As online environments can be perceived as supporting the constructivist paradigm, adopting rigid instructivist strategies may degrade the overall effectiveness of the encounters experienced by the learners.	These options link learning strategy to outcome and affect each component of learning design: problem solving; declarative knowledge; concept learning; principle learning; procedural learning; cognitive strategies; attitude & motivation and psychomotor (Smith & Regan, 1999).	The ways in which media elements are used and extent to which they are accessible will influence the individual components of learning design.

Table 2(a): Options affecting online learning design

Within the context of the design process, the team should be able to articulate the underlying pedagogy of the product, the different types of learning being addressed and the ways that media resources will be used to enhance the learning environment. When considered in terms of the specific issues that are critical to the overall design task shown in Table 2(b), the complexity of addressing educational and technological elements of the process is further emphasised. Embarking on the design and development of resources for online environments requires new layers of thinking to be added to the well-established principles of course development.

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COMPONENT	Issues
Prior Experience	Online learning is a new environment, and learners must have the requisite skills to effectively work within this paradigm.
Approaches to Learning	Does the provision of a range of media elements provide learners with the resources necessary to meet their approach to learning, and what impact will this set of options have on the overall development effort?
Learning Environment	The extent to which the environment is designed as a digital page or a virtual world will impact on the overall development effort (see Interface Design).
Pathways/ Sequencing	The strategies for online learning can establish predefined pathways or enable students to explore and discover different facets of the content. Managing these options to minimise information overload becomes critical.
Outcomes	In providing an online environment, are the stakeholders providing for a range of outcomes or are the consistent with predefined objectives.
Assessment	Closely linked to outcomes, are new forms of assessment being considered for the online environment, such as collaborative understanding and concept formation.
Level of Learning	What impact might governmental standards have on the design – and do those standards influence or constrain the preferred modes of delivery within the online contect?

Table 2(b): Online learning design – Major components

Interface Design

The interface between learner and computer is one of the most neglected aspects of online learning, and when coupled with our limited understanding of the complexities of the interactive process, suggests extensive work has to be done to achieve successful and ongoing communication between the learner and the environment. As detailed in Table 3(a), the options available for online productions can range from the non-contextual through to the theatrical, where the learner is conceptualised as an active player in the overall learning process rather than a passive observer (Laurel, 1991; Sims, 2000). Our position is that designers must spend more effort ensuring that learners are integrated into a narrative sequence of the learning process, rather than a familiar solution which sees content being presented in a glamorous and dynamic format but without necessarily achieving engagement with the content through the interface.

<table>
<tr><th colspan="5">Non-Contextual ◄--------► Contextual ◄--------► Narrative ◄--------► Theatrical</th></tr>
<tr><td>Information Design</td><td>Interaction Design</td><td>Input/Output</td><td>Navigation Design</td><td>Aesthetics</td></tr>
<tr><td>What procedures have been employed to ensure maximum communication of information?</td><td>Have the various interactivity options been catered for and communicated to the learner?</td><td>How clear are the options for entering and accessing content and responses?</td><td>Does moving between resources affect continuity of delivery or context?</td><td>How does the "look and feel" contribute to or detract from the communication experience?</td></tr>
</table>

Table 3(a): Influences affecting interface design

Overall, the conceptualisation of the interface must consider the strategies employed to position the learner within the *illusion* of the virtual learning environment; the way in which representations, metaphors, icons are employed to support communication; how design decisions affect connectedness and interference within the learner-computer interface and the extent to which animations and sound effects impact on cognitive load and degradation of learning (Sweller, 1988). The major issues for Interface Design are identified in Table 3(b) and are linked explicitly to the elements of Learning Design, one area that is often neglected by developers new to the creation of online resources. To maximise the online learning experience it is not sufficient to apply rigorous educational design to content materials, as the means by which that content (resource, activity, conference, reading) is presented to the learner will impact on its overall effectiveness.

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COMPONENT	Issues
User comfort – connectedness	Has appropriate usability testing determined the extent to which users are able to work with the resources and make the necessary connections between content elements?
User control User centred	In what ways are users able to control the learning process and link the activities to their own learning requirements?
Supports content structure	Has the interface been conceptualised to be consistent with the content structure while maintaining acceptable standards?
Supports learning design approach	Has the interface been designed to be consistent with the particular paradigm employed for the course?
Alignment of Mental Models	What strategies have been employed to ensure the mental model of the design group has been effectively communicated to the learner?
Customisation vs Individualisation	In what ways can the learner structure the environment to meet their own individual learner needs or preferences?

Table 3(b): Online interface design – Major components

Interactivity

Interactivity is about successful communication and, in the context of online learning environments, one of the most crucial success factors. As a component of the human-computer relationship or encounter (Anderson & Garrison, 1998; Sims, 2000; Sims, 2001), interactivity can include passive presentation, navigation, undirected exploration, directed involvement and specific manipulation. The extent to which these constructs of interactivity impact on the continuity of communication between learner and interface, content, other learners or other teachers is critical to the overall effectiveness of the experience and is inextricably linked to the factors and influences associated with content, learner design and interface design.

Interactivity is not simply a function of computer-based transactions, but a fundamental success factor for teaching and learning, especially when implemented in an online context. In most cases, regardless of any virtual community that exists, the learner will be working independently and therefore the effectiveness of those communications (interactions) will ultimately determine the effectiveness and efficiency of the learning environment.

As shown in Table 4, elements of interactivity can encompass both human-computer activity and human-human communication. Through the creative process, developers must consider those aspects of both the design and interface that might enhance or impede the success of the different, but often simultaneous, interactions. The ability of the learner to "inhabit" the interactive world presented to them is naturally critical to its success as a learning environment. The way in which the motor (navigational and control interactions), cognitive (engaging and thinking aspects of the interactions) and collaborative (computer-mediated interactions with other course participants) elements of an interaction coalesce with the task being undertaken will contribute to the successful engagement of the learner with the activity.

INTERACTIVITY	**Motor Cognitive Collaborative**
Learner: Learner	The exchange of ideas, resources and information between learners enrolled in a course of study.
Learner : Teacher	The exchange of ideas, resources and information between learners and teachers participating in a course of study.
Learner : Content	The means by which learners access and make meaning out of web-enabled content.
Learner : Interface	The means by which learners access learning environments and the extent to which they are successful in its navigation.
Teacher : Content	The way teachers create and interact with content - see Table 1(a)
Teacher : Teacher	The support provided for of community of teachers
Content : Content	To what extent are "intelligent agents" being employed to search and update content materials.

Table 4: Elements of interactivity

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Assessment

Much discussion takes place in educational institutions about how best to deploy multiple-choice or short-answer questions in online environments, and what form of authentication should be installed to verify the electronic submission of assignments or completion of remote examinations. However, these strategies seem to contradict those contemporary approaches to learning that advocate active participation by learner and teacher and enable self-assessment and reflection. One challenge therefore is to determine how you can take advantage of the online environment rather than attempt to replicate traditional testing strategies in another medium. As shown in Table 5, assessment can be teacher, peer or student directed and within that context, the way in which assessments items are presented becomes critical. The "peer-directed" option provides means for groups to determine and assess the learning outputs whereas the "student-directed" option provides for individuals to define and pursue specific learning outcomes. In addition, assessment may also focus on new environments in which the performance data is collected, such as real-world workplace environments.

ASSESSMENT	Teacher-Directed	Peer-Directed	Student-Directed
Assignments	To what extent do assessment items conform to "old standards"and what workload impact does this have on the teacher?		
Examinations	Are examinations required, such as for professional accreditation, or are other performance indicators sufficient?		
Project Work	What options are available for assessment through projects , and which of the participants is responsible for defining completion?		
Work Placement	Can performance in the workplace fulfil the learning objectives?		
Authentication	Is there concern about the integrity of assessment submissions, or are there other formats that might preclude this operation?		

Table 5: Elements of assessment

Student Support

Providing appropriate support for the learner cohort is even more critical in the online environment because in many instances they will be working independently in their preferred environment. Even though this environment may include collaborative work, the learner's only medium of communication is the computer, and therefore support becomes critical to ensure their mental model is consistent with that of the other stakeholders in the process. In addition to the typical help systems, announcements and guides, recent research (Sims, 2000) has suggested that more explicit support is required to bring the learner into the online environment, especially by eliminating assumptions that learners will know what to do and why they are doing it. The environments and issues that impact support are articulated in Table 6.

STUDENT SUPPORT	On-Campus	Mixed-Mode	Off-Campus
Auxiliary Information	How effective are the communities? Are they encouraged through collaborative activity or discouraged due to independent flexibility? What expectations do you have for your students? How do you plan to nurture students into the collaborative world of online learning? What support personnel and resources have been identified to ensure students will feel integral to the learning environment?		
Communities of Learners			
Institutional Support			
Features			
Personalisation			
Security			

Table 6: Elements of student support

Utility of Content

Within Australia, new digital copyright legislation and the proliferation of digital resources have provided incentives to focus on the international standards for online learning environments.

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A crucial component of any development exercise therefore is to examine the extent to which content can be used in multiple environments (within and outside the product being developed), the means stakeholders might have to customise the materials and the interoperability between other learning objects in the wider curriculum. Complicating these factors is the increase in legislative and compliancy conditions; at the time of writing, ensuring online resources do not breach copyright and are accessible for learners with disabilities are part of the quality control process. These aspects are shown in Table 7, with the assumption that compliance will achieved by ensuring a robust technological infrastructure underpins the learning environment.

COMPLIANCE	**Copyright**	**Accessibility**	**Infrastructure**
Multiple Use	What benefits would accrue from a Digital Object Management		
Customisability	System (DOMS)?		
Interoperability	Are the learning objects compliant with international standards?		

Table 7: Elements of content utility

One of the complexities on online development and evaluation is that issues and factors such as accessibility impact on a wide range of environmental and operational element of online learning. For example, while legislative or policy requirements might insist on online facilities being accessible to people with disabilities, the guidelines will also impact on the look and feel of the interface and ultimately in the communication between learner and people and objects within the learning environment.

Outcomes

The final factor of the proactive evaluation framework is an assessment of the extent to which outcomes have been successfully achieved. For example, measures of learning associated with both intra-curricula and extra-curricula activities; the level of learner satisfaction with the overall experience; the completion rates and the extent to which pass rates and grades are consistent with alternative delivery options. Overall the design effort needs to include items to enable a comparative analysis of student outcomes in relation to the overall development parameters, as shown in Table 8.

OUTCOMES	**Program Maintenance**	**Quality Audit**	**Teacher Performance**
Learning	Very simply, did we get it right?		
Satisfaction	What needs to be done to make it better?		
Results	Knowing the parameters that will be used to validate both quantitative and qualitative outcomes of the learning experience will be critical to its ongoing success?		
Outcomes v Objectives	To what extent will the learners continue in the program and develop a sense of lifelong learning?		

Table 8: Outcomes

Conclusion

The capacity of computer-based technology to display combinations of media elements and respond meaningfully to user actions and manipulations has been established for many years. However, the power and capability of the computer to support the learning process is often lost in a maze of marketing publicity and technical gadgetry. Unfortunately, without the requisite skills, it has become all too easy to create web-based materials without understanding the underlying principles of online, interactive, engaging learning.

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Rather than creating effective learning environments, many development initiatives have proven ineffective, with learning activities a confused labyrinth of information, links, colleagues, discussions and navigation. The factors and influences presented, which are considered critical to effective online learning, provide a framework for designers and developers to proactively evaluate their product. By enabling development teams to address the critical issues associated with the creation of learning resources for delivery in an online environment we will have a greater chance of ensuring the achievement of educational outcomes, with learners gaining significant value from their online experiences.

Given the complexity of this framework, and the importance of understanding the many layers of influence on developing effective online resources, perhaps the critical factor is whether online developers require a credential to practice. Indeed, the costs of implementation and the risks of failure may well make this an imperative!

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STUDENT AND SUPERVISOR PERSPECTIVES IN A COMPUTER-MEDIATED RESEARCH RELATIONSHIP

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Abstract

This paper presents the reflective perspectives of the student and supervisor in a successful computer-mediated research relationship. Key contributing factors are discussed in a dialogue format covering the role of computer-mediated communication (CMC), the projection of social presence, student self-efficacy beliefs, the role of information and communication technology (ICT), and interaction in online professional networks. Drawing on relevant theory, inherent challenges are addressed, informing some concluding suggestions as to how supervision might become more responsive to the emergent forms of research learning being experienced by escalating numbers of postgraduate students studying at a distance via ICT.

Keywords

computer-mediated communication, ICT, research, supervision, virtual supervision, postgraduate distance learning

Introduction

Predictions for the unlimited future of globalised education through the use of information and telecommunication technologies (ICT) have been widely described and discussed (Hanna, 2000: Evans & Nation, 2000). The capability of students to study electronically with no requirement for physical presence or geographic proximity to their chosen institution has been described as one of the most important capabilities that the Internet has provided and universities are marketing globally to any potential students with Internet access. The ease of use of electronic mail and electronic conferencing software for communication and of resource access via the World Wide Web means that students can complete a degree having never left their home environment or having never met their teachers or fellow students. Postgraduate study particularly has been found suited to a 'virtual' campus with students who are often juggling work and family commitments finding electronic attendance at a university campus much easier and often as satisfying as on campus study (Stacey, 1999). The field of flexible postgraduate research has been studied and reported extensively (Pearson & Ford, 1997; Evans & Pearson, 1999) as the phenomenon of remote supervision of research by electronic means has become more prevalent.

How well does this transformation of teachers and learners with no physical context for establishing relationships work? Is the student 'dislocated' in the process? How can social presence be established? How can a student complete successful research? This paper describes a case study of the pedagogical innovation of computer-mediated research as it uses information and communication technology to facilitate the research partnership. It is a description of the process of establishing such a partnership between a student based in Brisbane and a supervisor who was initially in Canada and Europe for the first months of supervision and in Melbourne for completion. The pair had never met, but worked together effectively over two semesters of a research project. The intensity of such a relatively short term research relationship condenses the process experienced in similar student-supervisor relationships which are established at a distance with electronic communication at their centre and presents a more easily analysed experience than the lengthy, often interrupted, doctoral lifespan. The experience will be discussed from the perspectives of each partner in the relationship as a dialogue, beginning with the student perspective and followed by the supervisor's response. Even the writing of the paper has followed the supervisory process as, after several weeks of email discussion, Wendy (student) wrote her perspective with input from Elizabeth (supervisor) about references and previous studies with Elizabeth's commentary added last. In this case with the comments remaining in the final text rather than integrated into a revised thesis.

Context of the Deakin Postgraduate Program

Deakin University is one of Australia's leading distance education providers having been originally established with distance provision as one of its main roles as a dual mode institution (Calvert, 2001). Of the current university enrolment of over 28 000, 13 000 are on campus students, 12 000 off campus (of whom nearly 11 000 are part time) and 3000 are multi-modal students who take some units on campus and some flexibly, usually to fit in with work requirements to support payment of their course. Within Faculty of Education Masters programs, Deakin has one of Australia's highest student enrolments with 797 students currently enrolled. The program is obviously answering a need for the age and stage of life of postgraduate students as all coursework units and supervision is offered in flexible mode with no required campus attendance. For primary course communication students are sent the Deakin Learning Toolkit, a CD-ROM which contains software to enable email, computer conferencing, World Wide Web access and library database search tools as well as a range of software tools suitable for research use such as the bibliographic software, EndNote.

This paper is based upon personal reflective accounts of a recent computer-mediated research experience that comprised the final year long component of the Masters of Professional Education and Training at Deakin University. Deeming the experience to have been functionally and academically successful, we have revisited the practical and qualitative aspects of both the supervision and the process and have identified the following key factors contributing to success from both a student perspective and a supervisor's perspective:

- effective computer-mediated communication including reciprocal projection of social presence by student and supervisor;
- a high self-efficacy belief of the student in the ability to perform in the remote context;
- an ability to utilise appropriate technology to access and integrate resources; and
- motivation to interact in the online professional network.

In also considering the inherent challenges, suggestions are made for ways in which students might be better prepared and supported to succeed within emergent forms of 'online' or 'virtual' supervision.

Wendy: Like the UK Open University research students described by Phillips (1985), the research project titled 'Online Teaching and Learning for the Support and Enhancement of Interior Design Education' was always 'mine' rather than my supervisor's. The project had some initial direction prior to supervision confirmation, creating a need for the supervisor to adapt to this direction. In my university workplace, the study arose from a perceived need to establish the technological literacy levels and affective responses of my own students to ICT, prior to the integration of a web-supported learning system. I also aimed to refine the outcomes of my research into a more widely adoptable student audit approach. My workplace was significant because it served as an informal network, input from which inevitably filtered into the research process and my dialogue with my supervisor. It also presented me with a vision of the conventional supervision construct as my postgraduate peers worked feverishly to the tune of research schedules and drank coffee in their supervisor's office. This served to reinforce the research supervision experience I was *not* having. My supervisor, Dr Elizabeth Stacey, was located in Melbourne while I was in Brisbane. We had never met, except 'virtually' in the previous semester's unit *Teaching and Learning with Computer Mediated Communication (CMC)* that was conducted using FirstClass computer conferencing and email.

Elizabeth: Wendy's final grade of the highest possible award for her research project helps to explain her as a capable and motivated self-directed learner. She fitted the profile of affective characteristics of a successful distance student compiled by Thompson (1998) that included "autonomy, tolerance for ambiguity and flexibility" (p. 15) as well as a self-directedness and an awareness of her previous performance and competence. This does not mean that she required no supervision but that we early on negotiated the requirements for the research project that Wendy could be relied on to complete, and she responded well to direction and quickly took ownership of her project. It was however, important that we establish a relationship and sense of each other's presence from an early stage of our electronic communication if I was to fulfil the multiple roles of advisor, guide, critic and friend described by Johnston (1999). Fortunately in a previous unit in which I had taught Wendy, I had used strategies in computer conferencing with the coursework group which had established a basis for such online presence (described later). Wendy's workplace support system also reflects an emerging pattern experienced by flexible research students who rely on such a proximal network while they are distant from their university campus (Evans & Pearson, 1999).

Postgraduate Supervision and ICT

Wendy: In examining my experience I recognise that I was one of the escalating number of off campus postgraduate students experiencing an emerging form of research education. It is characterised by the student and supervisor being remote, likely never having met in person, and where the process and experience of undertaking research is entirely enabled and defined by ICT. Tied to this emergent form of research experience is an increasingly diverse postgraduate population that has been recognised by Evans (1998), Frankland (1999) and Pearson and Ford (1997). With a focus on cultural and ethnic diversity, Ryan and Zuber-Skerritt (1999) also highlight the significant numbers of postgraduate students from non-English speaking backgrounds (NESB) now studying with Australian institutions, along with the implications for research supervision.

Elizabeth: As with the scenario Wendy has described above, my experience of supervision relies on ICT and its effective use. I currently supervise 10 doctoral students, five of whom are in other countries. One student is in Hong Kong, one in New Zealand, two in Canada, one in United Arab Emirates and of those within Australia, two are in another state, while even the three residing in Melbourne see me irregularly often preferring to communicate via email or phone. The Masters research students I supervise are also in other states of Australia, with one in Hong Kong, so they too use email or phone for contact. This reflects on the lives of all my students who balance busy work and research lives, and for whom the convenience and time saving of relying on electronic mail for communicating major ideas and reporting progress works well as long as there is the possibility of an occasional telephone call for the purpose of asking questions and making closer personal contact. This type of "electronic" supervision does require my communicating a strong sense of social presence to ensure that I can establish the relationship of trust and ease of communication required of the supervisor-student relationship (Bibby, 1999) that Wendy and I did in fact establish.

Wendy: In parallel, emerging forms of research supervision enabled by ICT are apparent in the notions of a 'virtual campus' described by Stacey (1997) and Walker (1998), and in the actual frameworks currently being set up to facilitate 'online supervision' and support remote research students. One example is the Project for Research-students' Online Supervision (PROS) underway at Middlesex University (Basiel, 2000). A suite of applications is being developed to create a 'virtual supervision environment' (VSE) in which the entire action path from enrolment to final oral presentation will be facilitated. Another re-conceptualisation of research supervision is made by Zhao (2001), who by identifying the changing nature of both postgraduate students and the society into which they emerge, offers a knowledge management model of research supervision. This model "…requires innovation oriented individuals (research candidates) and a research environment that provides networks of experts and easy access to knowledge technologies for knowledge creation, storage and transfer" (Zhao, 2001, p. 5). This departs greatly from the traditional, enduring and private 'master and apprentice' model lamented by Frankland (1999).

I describe my experience as an example of a *transitional* form of supervision rather than being in alignment with either of the two emergent models above. While the experience was completely enabled by electronic communication, the prescriptive path in the study guide and one-on-one privacy implied that we were to replicate the conventional student-supervisor relationship as best we could. Additionally, the opportunities afforded by ICT for process and student support were not at that point promoted in a structured way; instead we utilised those of best fit in an *ad hoc* manner.

Elizabeth: The idea of a virtual supervision environment is indeed still evolving though as Pearson and Ford's (1997) study of the Australian flexible research environment showed, it is acknowledged as an important new process under construction (p. 103). Evans (1998) described universities becoming larger and more diverse with "part of the enlargement is of a virtual kind as educational spaces become less confined by institutional walls…" (p. 85). The individual focus of the research project makes it harder to provide the online collaborative discussion and support framework between students that is provided in their coursework units but such environments are being attempted (Pearson & Ford, 1997).

Key Factors for Success in 'Online Supervision'

Having identified the key factors above that we believe resulted in both successful research outcomes and supervision, we will discuss each in relation to relevant theory and consider some of the related challenges.

Effective Computer-mediated Communication and the Projection of Social Presence

Social presence, defined by Garrison (1997) as "the degree to which participants are able to project themselves affectively within the medium" (p. 6), has gained importance in research into learning with computer-mediated communication (CMC) as teachers and researchers find that for cognitive presence to be sustained, social presence must be established effectively first. In communication research and theory, social presence has been identified as focusing on the nonverbal and para-linguistic signs of communication, like mimicry and gesture, that are lost with CMC. In the field of communications technology which studies social presence as the degree to which communicating participants are able to project their presence through the technology, social presence can be projected best when the verbal and non-verbal cues and the context can be also be communicated (Rice, 1993). By such criteria, CMC would be judged low on social presence (Lindlif & Shatzer, 1998) and the role of the participants in compensating for lack of cues becomes more important.

Walther (1996), writing from the field of communication research, reflected that early empirical studies into CMC use concluded that participants would be less sociable and more task-oriented, a notion he challenged. However since this early research, field research has shown that with unconstrained interaction time there are high levels of social interaction through email, computer conferencing, etc., which counter the empirical data, though without explaining its results. Walther drew on a social information processing perspective that suggested that communicators in CMC are as driven as any participants to develop social relationships. Given the longer time factor of an ongoing electronic relationship, they are provided with the opportunity for accrual of interpersonal impressions and for the gathering of social information through text messages, so relationships can still develop despite fewer cues. This would explain the theory of impersonality in time-limited CMC group communication research. When tested by Walther and Burgeon (1992) it was found that though interpersonal impressions were formed more slowly with CMC, relationships developed in the same way as in face-to-face situations, even becoming more socially oriented in the online context. Part of this was explained (and tested by research) as the effect of the anticipation of further future interaction which prompted participants to seek more personal information, act in more friendly ways and cooperate with one another.

Wendy: In the absence of interaction in a face-to-face setting between Elizabeth and I, the communication medium and ensuing dialogue became the tangible substance of the entire research process and documented its developments.

Having completed the first year of the Masters as a truly distant student living in Sweden, and then participating in Elizabeth's CMC unit, I commenced the research phase comfortable with electronic communication. Harasim *et al.* (1995) and our own class group had alerted me to both CMC's potential and perils. I was accustomed to the need for etiquette, dealing with the time lag of asynchronous exchange and operating in the absence of physical and social cues that many new students find disconcerting. Importantly, I had moved beyond the point where mastering the technology was the single most cogent factor. This is a point I will later revisit.

Elizabeth: In the online coursework units, I had developed a strategy for modelling the establishment of social presence. In the first weeks of semester I actively taught the students social practice and use of the software elements that help to establish social presence. Such factors as the use of reply to a message and quoting previous messages within new messages rose in student frequency in response to both my modelled practice and the specific directions I gave. The students responded to my lead and later as the small group process developed, the students became a cohesive and interactive community online.

Wendy: While I may have been accustomed to the lack of physical and social cues, their absence was particularly felt when supervision replaced the more sociable coursework. In communicating one-on-one with Elizabeth instead of with the class group, the need to both project and be receptive to social presence featured strongly. In a seemingly voyeuristic fashion I sought more familiarity with Elizabeth via her web presence, through her reported research and even by re-listening to a Deakin audiotape on which she had been interviewed. There was a definite need to know *who* my supervisor was.

In analysing the texts of our email dialogue over the year-long period, I have identified three typical forms of communication intent:

- practical exchange of information, e.g. a chapter in draft sent as an email attachment or details of a suggested resource from Elizabeth;
- process, e.g. explanation of what underpinned my actions in the attached text or constructive guidance from Elizabeth in the form of a reasoned suggestion; and
- affective/ social, e.g. surrounding commentary indicating how we were feeling about the process, current events and demands which was often humorous or expressed goodwill.

Remote supervision would have been extremely difficult had I felt that the latter form of communication was discouraged or viewed as improper. I admit to taking care not to assume too much familiarity or to seek advice too often or without consideration. Aware that I was one of many other students, I strove for efficiency in my email and actually expended a great deal of effort in ensuring that key questions were asked in advance so that I had responses in time for the periods I had free for research. This was particularly so during the report writing phase.

We spoke by telephone once during the entire project period and despite suggestion that the email dialogue served us well, the extent to which this incident strengthened our familiarity and rapport was compelling. Should Basiel's (2000) virtual supervision environment become viable with its multimedia and multi-channel communication, much of the compensation for absent cues required in CMC would be alleviated. This would then accommodate a greater diversity of communication preferences.

Elizabeth: The pattern of high social interaction accompanying the cognitive engagement of our research partnership mirrors the results of analysis of online interaction of my Masters coursework units. There, even though cognitive content became a main focus of small group learning relationships, high levels of social presence continued to be an important factor. When the groups were interacting in a closed group conference where they could potentially have begun to require fewer social presence factors at a time when they were familiar with one another and focussed on the cognitive content of their shared task, the rate of social presence factors was in fact even higher than when they were establishing their group relationship (Stacey, 2001).

As Walther (1996) proposed, relationships require longer to develop in an electronic medium, and Wendy and I developed a closer social relationship as we reached the most intensive phase of the research project when the written text was passed between us and developed into a final thesis. As we negotiated over content and interacted with one another's message text, asking questions, probing and complimenting the others' suggestions and ideas, the social content of messages continued at a higher level as messages of content and conceptual negotiation would include more personal and social comments. This balance of cognitive and social factors is an important result that contributes to the understanding for establishing an effective long term online relationship that supervisors and students require when communicating at a distance.

Self-efficacy Beliefs for Operating in the Remote Context

Wendy: With its absence of physical environment and organisational symbols, the centrality of communication, and a flexibility almost devoid of structure, remote research and supervision can be likened to remote work in virtual organisations in many respects. Employing Bandura's (1978) self-efficacy theory Staples, Hulland and Higgins (1998) found individual's self-efficacy assessments to be key factors in remote work effectiveness, perceived productivity, job-satisfaction and ability to cope. I identified several parallels with the remote workers above:

- the necessity to schedule both the project components and my available time;
- ensuring that time spent was productive (in order to feel a sense of progression);
- operating without the informal or formal benchmarking provided by peers; and
- judging when it was necessary to seek guidance or feedback.

Drawing from Bandura's work on students' cognitive self-efficacy (1997, pp. 223-31), I believe that survival as a remote research student is dependent upon the ability to function as a self-regulated learner. This encompasses aspiration, motivation, cognitive ability, meta-cognitive skills in monitoring and evaluating the process, and seeking and applying feedback. Quite fortuitously, three previous semesters as a postgraduate distance learner prepared me quite well to operate in this manner. However, my *disciplinary* studies, i.e. adult and flexible teaching and learning, and educational technology, were exactly and atypically aligned with what I was experiencing. I would venture then that students' self-efficacy beliefs in their ability to operate effectively in the remote context are highly contingent upon their prior experience and preparation, suggesting that institutional/ departmental expectations of students should be made explicit. Once enrolled, there could also be opportunities for reinforcing students' self-efficacy beliefs through structuring the initial research proposal, planning and communication in such a way that a range of requisite self-directed tasks and meta-cognitive self-evaluation is accomplished up front.

Elizabeth: Wendy's reflections concur with the findings of research into successful distance students in higher education (Campbell Gibson, 1998). Her suggested strategies for developing self-direction and self-efficacy are sound and timely. In the earlier structuring of the FirstClass online conferences, a discussion space was established for students completing research projects, but as with the conferences established for PhD students, the disparity of topics and methodologies between students meant that students worked on an individual basis and there was little shared discussion. However in a professional doctorate conference with structured, required research tasks there is an active research discussion, so consideration needs to be given to distance students developing an online community discussion through defined tasks of the kind Wendy suggests.

Utilisation (and Exploitation) of Appropriate Technology

Wendy: As mentioned earlier, I entered the research phase at a point where the associated technology had become gloriously salient. It was possible to move seamlessly between email, discussion fora, web-based resources and database interfaces, and benefit from the online support at both Deakin and my own institution. Exceedingly valuable too, was the informal technical support I had at home to remedy any technical crises. I recognise that this represents a 'best case' scenario and could be assumed for only a small number of remote research students. Referring back to the self-regulated learner, a component of this is the ability to seek, apply and learn from technical assistance, but the fact that this might rely on email or long distance telephone calls is an obvious hurdle.

Writing specifically on the supervision of NESB students, Ellis and Phelps (1999) identify some key technology utilisation issues that apply to all research students. The first is the student's practical ability to use the hardware and software that assist in locating resources; organising, managing and analysing data; and preparing drafts, reports or the thesis document. Again, students will possess very diverse abilities in these areas, and I developed several such skills during the research period. In the face of the vast information sources now accessible via the web and 'deep web' databases, the second major issue is students' ability to critically approach information quality, extending to the evaluation and synthesis of information. Immersed in the teaching and learning discipline, I was already cognisant of critical literacy, and used guiding principles from the theory. The supervisor's role was really important here in indicating whether my knowledge of the literature was widely representative and authoritative, or if I had been going up the 'cyber garden path'.

Elizabeth: As described in the introduction, Deakin University has developed key strategies for a yearly provision of software and multimedia guidance for research students through the Deakin Learning Toolkit CD-ROM and a strongly supportive library service that has developed extensive online portals to online resources. However, it is the guidance of the supervisor in using these capabilities and providing direction for the most effective use of Internet resources that changes and transforms the distance research relationship through the use of ICT tools. Feedback and critical direction is an important role in supervision but more so with the electronic nature of literature searching as it has developed today.

Interaction in the Online Professional Network

Wendy: Stacey (1997), Walker (1998) and Basiel (2000) have integrated or plan to integrate online peer and/or expert interaction within the research supervision process. I regard such interaction as essential in the potentially isolated remote context. Due to having a fairly unique topic at the time, I did not participate in a formal online conference, but instead informally maintained or developed a variety of professional contacts via email or discussion lists, sometimes being 'introduced' by Elizabeth. An individual's web presence was often useful in providing peripheral cues about the person and their context. This informal interaction fertilised the research process and assisted in mediating some of my beliefs and misconceptions.

I experienced a phenomenon in the online professional network that I believe to be extremely valuable to all research students, but particularly those who experience little face-to-face professional interaction, and that is the tendency of the medium to dismantle hierarchy. It is highly compelling to read an expert's journal article, for example, then make a related inquiry via email and receive a timely response! I also feel that a distinct lack of hierarchy was evident in my relationship with Elizabeth. She has alerted me to the fact that just about everybody, irrespective of experience or academic calibre, has something to offer another. The online medium and its role in professional discourse should be promoted as a valuable and current resource.

Elizabeth: The dismantling of hierarchy is a phenomenon tracked in the literature about postgraduate supervision (Johnston, 1999) and often attributed to study in the non-scientific disciplines where ideas are negotiated more collegially. However the advent of online supervision has hastened this democratising of the relationship when differing power or status cannot be easily perceived in electronic communication. In the supervisor-student relationship, the importance of establishing a trusting social interaction pattern online requires any such hierarchy to be dismantled as soon as possible and Wendy and I developed an easy communication pattern by both of us messaging informally but purposefully from the early stages of our online partnership.

Concluding Thoughts

Reflecting further on the key factors to succeeding in remote, computer-mediated research identified above, it is evident that the student's experience embodies not only the actual research project and reporting, but also a necessity to interact with a complex range of information and communication technologies, electronic resources and networked individuals in the shape of the supervisor/s, peers and experts. Preparation for this task must be developed systematically with the students directed to university facilities provided for online support. Public conferences in FirstClass which give access to IT support, library personnel and distance education support staff have provided an important virtual campus environment for distance students and postgraduate student organisations have developed online discussions to provide information and support for research students.

Wendy concluded that the institution imposed research preparation is both outdated and inadequate for students remote from their campus as she was. The experience of postgraduate research has practically and qualitatively changed for off-campus students who rely to such a large extent on ICT to provide the support system of the campus. Student preparation in the form of research methodology studies is only one component of the full, complementary set of technical and critical abilities that are demanded. Establishing a strong relationship with one's supervisor online with an expectation of regular electronic communication is an essential step to a successful research project. This should be supplemented by a pre-requisite preparation and induction process that precedes the research project stage. Addressing the key areas discussed would result in explicit student accomplishments that would then be systematically applied and further developed.

Further research to inform a responsive educational design for computer-mediated research is timely. Our research partnership was successful despite a lack of the prerequisite research skills training required because we were able to provide these through our computer-mediated partnership and through Wendy's discipline and university context. The computer-mediated communication supported the research process because of the way we defined the use of electronic communication and because of our strategies to focus on developing social presence in our online environment. Our strategies need to be defined and developed as a process to support other students who are attempting to learn to research at a distance via ICT.

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A "TROJAN HORSE" APPROACH TO TEACHING ABOUT ONLINE DESIGN

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Abstract

A range of skills and knowledge are required for the development of quality educational material for online delivery. These include an understanding of instructional and multimedia design issues as they relate to the online environment. Although academic staff becoming involved in online education recognise the need for training in the technical skills involved in creating educational web sites, this paper argues that they do not recognise the importance of these design skills. This paper describes the inclusion of training in these areas as part of a basic introductory skills building workshop.

Keywords

online education, staff development, multimedia design, web usability

Introduction

The development of an online learning environment requires a range of skills and knowledge. Technological skills, ranging from relatively simple skills such as creating web pages using an HTML editor to complex programming abilities, are immediately obvious as an essential ingredient for producing online material. Another essential for any course is the subject matter, and Passmore (2000) argues for recognition of the importance of the content expert, in the form of the faculty member, as a valuable resource in the move to online education.

These two ingredients are possibly enough to create an online course. However, there are other factors to consider if the course is to be an effective learning tool. The importance of developing new pedagogical approaches to make best use of the opportunities and limitations of the web has been the subject of many recent studies (e.g. Ellis & Phelp, 2000; McLoughlin & McCartney, 2000).

Another important area to be considered is what Jakob Nielsen refers to as web usability (Nielsen, 2000). If learning is to be delivered online, it is important to maximise the students' ability to access it, through sound design principles.

Because of the range of skills required, the most effective way to produce online educational material is to use a team approach bringing together content experts, educational designers, multimedia designers and computer programmers to each contribute their expertise (see Keppell, 2000). However, in practice, online courses are often developed by a single person – usually the lecturer responsible for delivering the course.

Previously it was the case that this single-handed approach to online development was the sole province of "lone rangers" - people with a reasonably high ability and motivation to master the necessary technology. This person will usually invest a reasonable amount of time in learning to use the technology, but often is unaware of the design issues.

The use of software packages such as WebCT, which provide pre-programmed modularised online tools and features, makes it relatively easy to create online courses. This enables a much greater number of academics to become web authors, and may be seen by some universities as a way of increasing their online presence. However, the issue of good design must still be addressed.

Background

Central Queensland University is a regional university with a large proportion of distance students and multiple campuses, including international campuses. The focus of CQU is on flexible learning opportunities and online delivery is seen as an increasingly important element of that.

Beginning in 2000, there has been increasing use of WebCT as a tool for the development and delivery of online courses. There are currently 72 courses either being delivered or under development using WebCT. The Educational Design and Multimedia Unit (EDMU) has developed some of these courses using a team approach while others have been designed and developed primarily by faculty members with varying degrees of support from EDMU staff.

As part of the support for academics developing WebCT courses, a program of workshops is being developed focussing on different aspects of using WebCT for course development and delivery. The initial workshops, first delivered in February 2001, aimed at developing a general familiarisation with the WebCT environment and basic skills in managing courses that had been developed by EDMU.

In initial workshops, staff were enrolled as students in a sample course to gain an understanding of the WebCT environment, the functionality that it offers and the range of tools that are available. It was also intended to give staff the opportunity to experience an online learning environment as a student. For many academics this is a new experience (see Bennett, Priest & Macpherson, 1999).

There has been a high take up rate of these workshops with all offerings being oversubscribed. Over seventy staff members participated in workshops in the first six months. Anecdotal evidence indicates that staff are prepared to devote some time to learning about WebCT because they see it as being a technology that they may be required to use in the near future.

In contrast, forums, such as regular lunchtime seminars, devoted to investigating design issues are quite poorly attended. These tend to attract a small core group who already have an awareness of the importance of good web design.

It was felt that while the need for training in the technological skills of using WebCT was recognised by teaching staff, there was little awareness of their need for training in the area of good design for online courses. However, the complementary nature of these two areas suggested that they could be taught together. It was decided to use the technical skills training as a Trojan Horse – a gift that we anticipated would be welcomed by staff members interested in the development of online courses with information about design issues hidden inside. Staff would then be exposed to the important areas of educational and usability design, without them having to actively seek this information.

Course Design and Content

In designing a sample WebCT course for the introductory workshop, principles of educational design and user-centred web design were introduced in two ways: by using examples of the principles of good design in the development of the course and also by using the principles as the subject matter of the course.

Instructional design information was based on CRAFT, an online tutorial for designers of distance education material (Duncum, Priest & Cleal, 1998). Although some shift in the pedagogy is required to adapt the principles of distance education to online delivery, the principles chosen for inclusion in the sample course were fairly general and were considered to be appropriate for online material. Additional information was added relating to online interactivity.

Other modules of content looked at general web design issues such as an appropriate writing style for online material, navigation design, visual design and site structure. Technical issues such as the differences between computer systems, download times, plug-ins, etc., that can affect the students' ability to access different types of materials were also discussed.

The course was designed to require a time commitment of no more than four to five hours to make it acceptable to academic staff with high demands on their time. For this reason, the amount of content was limited. The information provided was not detailed, but rather intended to raise awareness of the issues and general principles. References and links to more detailed information were provided. The sample assessment items, such as an online quiz, also related to the content area.

Modelling Design Principles

In addition to providing this information as the content of the course, care was taken to ensure that the same principles were adhered to in the design of this course. One of the teaching strategies modelled in this course was to ask the participants to reflect on their learning experience. This included drawing their attention to particular design features used in this course, such as the use of universal navigational elements. The participants were then asked to use the communications tools included in the course to share their views about the usefulness, or otherwise, of these elements.

Practical examples of various features were given and the participants were encouraged to reflect on the issues that emerged when using them. For example, a short video was included. Participants were asked to download the necessary plug in, even if they already had it installed, before viewing the video. They were also reminded that the time to download the video would be substantially longer for a student on a modem. They were then asked to consider the values of the video and the inconvenience involved in viewing it.

Feedback

Although the formal evaluation of the training workshops has not focussed on the content matter, informal feedback has been promising. This has included requests from participants to have continued access to the material after completion of the workshops, as an aid to the development of their own courses.

In both face-to-face and online discussions during the workshop, there has been considerable comment about the design of the course and the principles discussed in the content. Many of the comments indicated that the participants had not previously considered the particular issue under discussion. In some cases the participants disagreed with design decisions that had been made in creating the course. It was felt that this was a positive outcome for the workshop, as it indicated that the participants were thinking critically about the issues raised.

There has also been feedback from participants who have since developed their own courses indicating that they have incorporated design principles suggested in the sample course. A more formal evaluation of the extent to which this is happening is planned.

Future Development

The sample course was initially used in the fixed timeframe of a workshop. It is now being redesigned to be available online for staff to visit at a time that suits them. The workshop activities that lead the participants through the many features and tools that WebCT offers will be retained, but broken down into discrete modules to give more flexibility to the user. Facilitated workshops will continue to be available for those who require a higher level of support.

Later workshops in the program will focus on creating courses in WebCT and the use of specific features. Information relating to design issues will be included more overtly in these workshops. For example, the principles of an appropriate writing style for online text will be discussed as part of learning the skills to add content to the course.

Conclusion

Although professional training targeting instructional multimedia design issues would be immensely valuable to all academic staff involved in online teaching, experience indicates that only a small number of the target group perceive a high enough need to devote their time to it. However, by including exposure to these principles in complementary skills-based workshops, an awareness of their importance can be developed.

The anecdotal evidence indicates that using the principles of design as the content of a sample course used in a skills-based workshop has reinforced the usefulness of the course as an exemplar of online design. There are indications that the course has succeeded in raising awareness of the principles of good design for online material. It is anticipated that this will be further supported by the adoption of these principles in the future development of online courses by the workshop participants.

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ENCOURAGING STUDENTS TO INTERACT WITH ANGULAR QUANTITIES

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Abstract

An interactive multimedia module in rotational kinematics has been completed at Edith Cowan University for first year physics students. In this second version, highly interactive testing pages have been added to help students improve their conceptual understanding of angular position, angular velocity and angular acceleration. Other pages have been revised and an on-screen calculator added to predict type pages. Students find the interactive testing pages useful and believe the module improves their understanding of rotational motion.

Keywords

rotation, kinematics, motion, physics, simulation, interactive, multimedia, concept

Introduction

A rotational multimedia module was created at ECU (Edith Cowan University) for use in the first year physics program. It allows students to explore concepts in rotational motion through the motion of the rotating blades of an interactive wind generator. An early version (or version 1) of the module was described and evaluated in a paper presented at ASCILITE99 (Swan, 1999).

However the module presented at ASCILITE99 was not a finished product. There were insufficient funds to complete some sections or include some planned features. In addition, it was found that students did not use the module in the way intended. They focussed on aspects of the module where they could gain practice in solving problems of a mathematical nature rather than interacting with the core concepts on the more interactive play pages.

A faculty teaching and learning grant of $5000 has allowed the module to be finished and made more interactive. The module (version 2) was completed in December 2000, and was trialed with students in semester 1, 2001. After a brief overview, substantial changes made to produce the second version will be described and some student responses discussed.

Module Rationale and Overview

In this section a brief rational and overview of the rotational motion module is given. The general layout (and much of the content) of the first and second versions of the module are similar and only the salient points are repeated here. The reader is referred to Swan (1999) if a more complete description of these parts is required.

In teaching rotational kinematics, popular first year university textbooks (Halliday, Resnick & Walker, 1997; Serway, 1996) make strong use of analogy between familiar linear quantities and the corresponding and less familiar analogous rotational quantities. Unfortunately, there is a wealth of evidence (Arons, 1996) that too many students at this level do not have correct conceptions of these linear variables, and for these students this methodology cannot be expected to succeed. An

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interactive multimedia approach provided a unique opportunity for students to gain concrete experiences with rotational variables through the use of simulations rather than more abstract experiences through analogy. Financial support of $20,000 was granted by ECU to develop the first version of a rotational motion interactive multimedia module (Swan, 1999).

The module was created using Macromedia Director and is able to run on both PC and Mac platforms. Central to the module is an interactive simulation of the rotating blades of a wind generator through which angular concepts are explored. The equivalent of a Pentium III PC (with 64 MBytes of RAM) or higher is recommended to ensure smooth simulations of rotational motion.

The module was designed with an open architecture to allow for different learning needs and styles. After a short introductory sequence, students have the freedom to choose on which topic they start, and what pages they subsequently access. The content is divided into five topics:

1.	θ	Angular position (and displacement)
2.	ω	Angular velocity
3.	α	Angular acceleration
4.	v,a+s	Linear variables (and their relationship to rotational variables)
5.	=	Rotational equations (kinematic)

Within each topic, students can access up to three distinct types of pages. *Play* pages provide opportunities for students to get a 'physical feel' for the rotational quantities. Diagrams and/or simulations support the topic content on *theory* pages. Students can apply and test their knowledge on the *predict* pages.

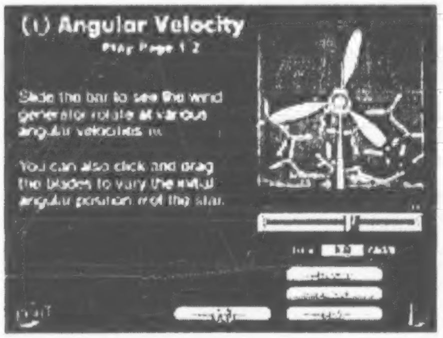

Figure 1: Angular velocity play page

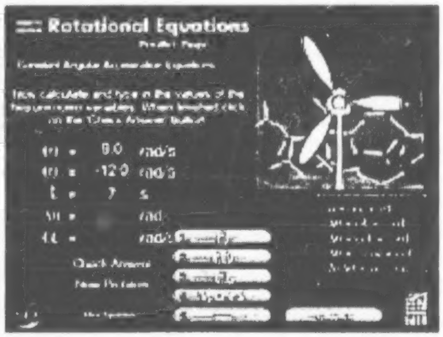

Figure 2: Rotational equations predict page

The play page for angular velocity is shown in Figure 1. By sliding the bar, students can vary the value of the angular velocity and immediately see the affect on the rotating blades of the wind generator. In using the first version of this module (Swan, 1999), students were found to spend far more time (a staggering 43% of their total time) on just one page; the rotational equations predict page. This page (with modifications) is shown in Figure 2, and provides students with practice in solving problems using the kinematic equations for constant angular acceleration.

Innovations and New Features

Funds from the teaching and learning grant allowed us to complete unfinished sections, make minor corrections, and generally reorganise and revise some of the pages after student feedback. Figure 2 shows some of the new features included in the second version of the module that were originally envisaged for the first. Students can now display the kinematic equations and on-screen calculator thus providing the necessary tools on-screen to solve the problems. On a PC the on-screen calculator is the Windows 95/98/2000 calculator. The topic navigation bar is also numbered

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from 1 to 5 to provide guidance in the form of suggested topics. The feedback given for incorrect answers has also been expanded.

The major innovation is the creation of four interactive testing pages in which the rotational motion simulation is central to the testing. These four new pages are shown in Figures 3 to 6.

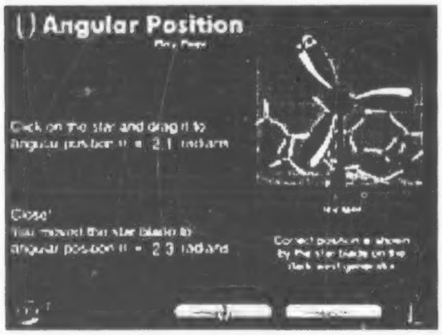

Figure 3: Angular position interactive testing play page

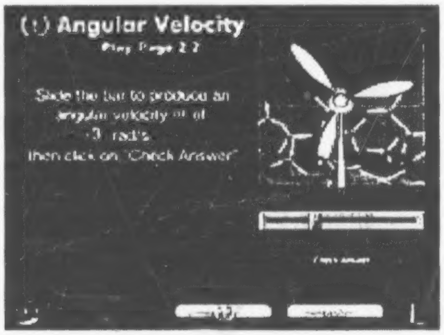

Figure 4: Angular velocity interactive testing play page

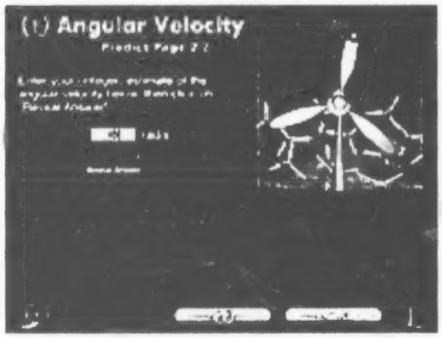

Figure 5: Angular velocity interactive testing predict page

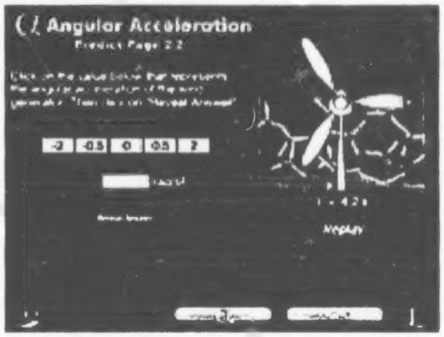

Figure 6: Angular acceleration interactive testing predict page

In these new pages students can test their ability to link angular quantities with the actual rotational motion. In the play pages, students are tested on whether they can adjust the simulation to produce the rotational motion corresponding to a given value for angular position (Figure 3) or angular velocity (Figure 4). In the second predict pages, students watch the rotational motion, and then estimate the value of the angular velocity (Figure 5) or angular acceleration (Figure 6). Appropriate feedback is given on closeness of the student's estimation.

The level of interactivity with the core conceptual topics (angular position, angular velocity, and angular acceleration) has been substantially increased with the creation of these four interactive testing pages (Figures 3 to 6) that require higher level thought processes than the original *play* pages (e.g. Figure 1).

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Evaluation and Discussion

The module was evaluated by eight volunteers from SCP1111 Physics of Motion in the week after the rotational motion had been covered in lectures late in semester 1, 2001. Students were each allowed up to 40 minutes with the module. They were also asked to take identical conceptual pre- and post-test, as well as completing a module evaluation. I sat behind the students and recorded the pages accessed and other notable events. The preliminary results are presented here.

Most students used this second version of the module in a similar way to the first version. While the addition of new interactive pages encouraged them to spend more time developing their conceptual knowledge, they still preferred to spend a large component of their time undertaking the mathematical exercises on the rotational equations predict page (see Figure 2). The new features ("Show Equations" and the on-screen calculator) were used extensively on this page.

Students overwhelmingly believed that each of the four new interactive pages were useful to them, and one student (who was the only very weak student) spent almost twice as much time than average on these pages. This student showed a dramatic conceptual test score improvement from 10% in a pre-test to 80% in an identical post-test. It was fascinating watching this student progress through these pages, making common mistakes, referring back to previous pages, and then slowly and methodically getting it right! I believe that this module will be very instructive for weaker students.

In evaluating the module, students were divided however on whether it was clear what should be done next. This is not unexpected given the open architecture for accessing the 20 topic pages of the module. Students did unanimously agree that the content was pitched at the right level and that their understanding of the content had improved. When the analysis of the data is complete, it is probably that a strategy for guiding students will be implemented for students using the module in 2002. This could include encouraging students to check their conceptual understanding on the interactive testing pages before progressing to other parts of the module.

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INFORMATION LITERACY FOR STUDENTS IN EARLY CHILDHOOD

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Abstract

Work-in-progress is summarised for the Generic Information Skills Training (GIST) project which aimed to teach information literacy skills to first year undergraduate students at the Institute of Early Childhood, Macquarie University. The findings in the first year of its two-year cycle suggest significant benefits to student learning. The success in the acquisition of generic information literacy skills is interpreted to be a reflection of the learning design of the project, which took as its cornerstone, the contextualisation of the targeted skills within the course tasks and assessments.

Keywords

generic IT skills training, information literacy, early childhood

Background and Rationale

This paper will report on a collaborative project, Generic Information Skills Training (GIST), between the Institute of Early Childhood (IEC) and the Macquarie University Library Information and Technology Training Unit (I&TTU). Integrated within the first year core course unit Early Childhood *Teachers as Researchers*, GIST was framed within the context of developing information literacy skills in a flexible, web-supported learning environment. The extensive use of online technologies in the delivery and teaching of the unit, combined with the need for students to develop information skills involved in locating, managing and using information for learning, research, and work-based purposes called for an approach to the development of information literacy that recognised the synergy between IT and information skills (Bruce, 1998; George & Luke, 1995). While these skills and capabilities are recognised as being essential for the duration of the students' university careers, they are also central to the definition of lifelong learning, and therefore constitute a significant component of undergraduate students' education (Candy, Crebert, & O'Leary, 1994). The rationale for GIST was further supported by the generic definition of information literacy put forward by DETYA (2000) as "the set of knowledge and skills needed to use information technology at a level appropriate to a person's position, work environment and discipline and the ability to continue to develop them into the future."

The teaching of information literacy is not uniformly adopted in universities (Winship, 2000) and comparisons between student groupings reveal significant differences with respect to access; females report significantly fewer skills than males, and part-time and distance students report significantly fewer skills than full-time and on-campus students (Oliver & Towers, 2000). At IEC, nearly all students are females, nearly half are enrolled as part-time and about a third are distance students, thus making these students a clear focus for support programs in information literacy. Although ongoing Library workshops on various information literacy components (including IT skills, and information access and management skills) have always been available for students on the basis of need or interest, student feedback indicated that the skills and knowledge they gained were not easily generalised to learning and work-based contexts. Therefore, the strategic collaboration for the GIST project between the I&TTU and IEC provided an ideal learning partnership to teach information literacy by interweaving the skills and competencies into the unit requirements and assignments. Such an integrated approach has been demonstrated to yield favourable learning outcomes (Souchek & Meier, 1997).

Project Description

Teachers as Researchers was taught in 2000 in flexible mode over 11 teaching weeks in a weekly two-hour lecture, and one-hour tutorial format for internal students, and two on-campus days for distance students. A supporting unit web site provided access to digital lecture recordings, lecture materials, tutorial exercises, and online discussions through the bulletin board (contribution to which were a course requirement). Lecture recordings (both online and tape) and print-base materials were provided for distance students.

The information literacy skills to be developed encompassed many of the core skills defined by the Information Literacy Standards developed by the Council of Australian University Librarians (CAUDIT, 2001) and included key-boarding skills, proficiency in using email, bulletin boards and online discussion groups, and proficiency in locating, using and authenticating information on the world wide web, as well as using web-based interfaces to online research databases. Training was integrated into the teaching program in the following manner: on-campus students had four face-to-face workshops run by the Library's I&TTU in the tutorial sessions in weeks 1, 3, 5 and 7; distance students had these sessions embedded within the weekend on-campus school, as well as evening workshops. The workshops covered: a) accessing and using the online unit, b) using online research databases I, c) advanced use of online research databases II, and d) searching the Internet for scholarly material. Training booklets were provided for each workshop to assist in the review and consolidation of skills. In addition to these set workshops, two safety net sessions were available to students needing further support. Ongoing consultation with the I&TTU staff was available for students with queries.

Each workshop interfaced with an assessment task which required the use of the skills and competencies acquired. The tasks covered: a) compulsory weekly bulletin board discussions to encourage students to reflect upon and apply the course content, b) an individual research project proposal in which evidence of the use of electronic research databases had to be demonstrated in the background and rationale section with the hardcopies of the referred online abstracts attached, and c) a collaborative research project which required the students to augment their background research with scholarly material obtained from the Internet. To assess student gains in achieving the required skills, a Core IT Competencies Inventory was developed. This tool determined the baseline as well as the post-training measures in students' PC skills, accessing the unit online, accessing and using online communication facilities, finding and retrieving information from electronic databases, and searching the Internet for scholarly material. Additionally, students also completed an online unit evaluation which sought to examine their experiences of the integrated approach to acquisition of information literacy. In particular, information was sought on the effectiveness of the training and support provided in each of the workshops, the usefulness of the training booklets, and the overall experience. The results of the online evaluation are reported below and in the accompanying Table 1.

Results

Of the 292 students enrolled in Early Childhood *Teachers as Researchers*, 237 students completed and submitted the online unit evaluation, of whom 77% were on-campus and 22% were distance students; 30% were mature-age (over 25 years) students; 46% were first year and 35% were third year students. On average, 9% of the students reported not to have attended each of the workshops.

The results from the online evaluation revealed that overall, majority of the students improved their computing and Internet skills as a result of the training (Table 1, Item 1). Following the first workshop on accessing the online unit, only 30% felt they needed additional training in navigating the unit site and using the communication facilities; however, only 7.5 % reported to have attended a remedial Library workshop. Any additional training needs were met by Library reference desk (19.8%), peer assistance (43.4%), teaching and technical staff (16.4%), information on unit web site (27.4%) and accompanying booklets (42.6%). The training booklets were regarded as being helpful (Table 1, Item 4); nearly 67% of students had referred to them sometimes, often or always.

	% Response				
Questionnaire items	5	4	3	2	1
1. Assessment of computing and Internet skills[1]					
Before training	9.2	31.6	38.3	16.0	3.3
After training	19.8	60.3	17.7	0.8	0.0
2. Usefulness of the workshop on database research[2]	30.8	45.5	15.5	3.7	2.5
3. Usefulness of the workshop on researching the Internet[2]	21.5	48.5	19.4	3.3	2.9
4. Agreement that the training booklets were helpful[3]	24.8	50.2	21.0	1.2	0.8
5. Agreement on relevance of skills in study & professional work[3]	47.2	40.9	8.8	1.2	0.0
6. Rating of the overall contents & quality of the workshops[4]	18.9	54.0	22.3	3.7	0.0

[1] Excellent=5, Good=4, Average=3, Inadequate=2, Non-existent=1
[2] Essential=5, Useful=4, Neutral=3, Not very useful=2 Unnecessary=1
[3] Strongly agree=5, Agree=4, Neutral=3, Disagree=2, Strongly disagree=1
[4] Excellent=5, Good=4, Satisfactory=3, Poor=2, Very poor=1

Table 1: Percentage distribution of responses to selected online questionnaire items

Overall, the students found the workshops on database and Internet researching to be essential or useful (Table 1, Items 2 & 3). Further analysis of the application of skills to their learning revealed that after the workshops on online database training, 99.1% of students reported having used the Library databases (e.g., ERIC, Australian Education Index, PsychINFO) and subsequent to the workshop on Internet researching, 73.4% reported having used a search engine e.g.,Yahoo, Google, BUBL, or directories of e-journals. Most importantly, 74.6% of the students agreed or strongly agreed that after such training, they could evaluate material found on the Internet for scholarly content and suitability for use in assignments, with strong agreement that the skills they developed were relevant for further study and professional development (Table 1, Item 5); indeed, nearly 75% rated the workshops as being good or excellent in overall contents and quality (Table 1, Item 6).

These preliminary results strongly suggest that the integration of information literacy within a relevant and immediate learning experience has been successful as indicated by 98% student satisfaction or better rating of the unit overall, and 96% satisfaction or better rating of the Library workshop components. The preliminary GIST evaluation results strongly suggest that the integration of information literacy into unit assessment tasks has elicited positive learning outcomes, as well as being viewed as being necessary and valuable learning experiences by the students.

In 2001

Despite the success suggested by the 2000 results, one prominent theme that emerged from the student evaluations was that the tutorial time spent in training at the Library was at the expense of scaffolding necessary for the unit content, learning processes and assignments. As Bruce (1998) points out, information literacy must not lose its relational approach; its acquisition should not necessarily displace learners' support needs in acquisition and consolidation of basic course content and conceptual knowledge and understanding. In 2001, the second year of the project, there has been the opportunity review and modify the program in light of such feedback. As a result of GIST, the information literacy training offered by the Library is now presented as an online, self-paced, self-assessed learning module that can be tailored to the needs of different disciplines and learner groups on offer to all Macquarie students and staff.

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FINNISH VIRTUAL (ONLINE) COLLABORATIVE UNIVERSITY – A MODEL FOR AUSTRALIA?

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Abstract

Virtual universities are springing up around the world. In this paper two planned online university ventures are contrasted, one from Finland and the other from Australia. The meaning and operations of these institutions are considered with respect to the virtual teaching and research nexus, cost issues and their capability to respond to quick changes in knowledge. The issue of organisational collaboration underlying these plans is explored in terms of negative and positive examples. Their virtual operations are discussed in terms of the fundamental educational interactions leading to observations to be considered in the development of new virtual and online education provisions.

Keywords

virtual university, collaboration, online teaching, virtual research, interaction

Introduction

On the 18th of January 2001 one of the latest national virtual university ventures was announced. This virtual university is being set up in Finland, one of the most technologically advanced countries in the world, where the take-up rates for mobile phones and Internet connections are among the highest in the world. It is also a small country, with current population of only about 6 million. Six days later the Australian federal opposition leader, Kim Beazley, addressed the National Press Club in Canberra, announcing the establishment of the University of Australia Online (UAO) if the Australian Labor Party wins the next election (Beazley, 2001b). Thus on opposite sides of the globe modern initiatives to improve tertiary education expect to take advantage of the Internet. This paper seeks to consider the nature of these ventures, to see if there are parallels between them, and to assess the alternative approaches.

The model adopted for the Virtual University of Finland (Suomen Virtuaaliyliopisto, SVY) is a collaborative model. Instead of creating a new separate national institution, like the open universities of UK, Netherlands, etc., and the structure implicit in the ALP proposal for University of Australia Online (Beazley, 2001a), the SVY is building an online presence based on all the existing Finnish Universities. The existing universities will provide the academic structure, such as student enrolment, teaching and accreditation, through the SVY. The SVY (online) will provide the infrastructure for the educational online delivery and interaction as well as facilitating the inter-university subject and course delivery negotiations.

In a new collaborative virtual university venture at least three areas need to be considered in depth to ensure a reasonable chance of success. They are the concept and sense of a modern university, the organisational collaboration that underpins the activity of the entity, and the virtual nature of the operation. This paper will attempt to open up the discussion from these three perspectives.

Meaning and Operation of a Modern University

Teaching and Research Nexus

In the national DETYA sponsored conference on "Online learning in a borderless market" earlier this year, the vice-chancellor of the Central Queensland University, Lauchlan Chipman, explored the notion of a university in the 21st Century (Chipman, 2001). He discussed how well various entities commonly identified as "universities" met the criteria used by the Australian Vice-Chancellors Committee (AVCC):

- the institution must have a legislative basis for its establishment, or alternatively, it must identify the formal basis on which the institution is given recognition by the government;
- the institution will have a stated and actual commitment to the advancement, dissemination and preservation of knowledge through teaching, scholarship and research;
- the institution's resources and infrastructure will be at a level sufficient to sustain a broad range of teaching, scholarship and research; and
- the institution and its staff will have an appropriate research record, together with research plans and capabilities.

He argued that many institutions commonly regarded as "universities" did not fully meet these criteria. Although chiefly arguing that the notion of a university is place and time sensitive, he also commented on the assumed necessary connection between teaching and research in a university, and criticised this assumption on a number of grounds. For example, he was concerned about the costs of maintaining this nexus in an online, i.e. virtual, university. In his view there may be a mismatch between the teaching, or award provision needs, and the research needs in a given community, i.e. just because more teaching is needed in a given discipline, that discipline need not be the highest research priority as well. Thus he indicated it might be quite feasible to provide online teaching functions, commonly recognised as typical of a university, without the associated research activity and costs in a virtual university.

In this respect the collaborative virtual/ online university model has much to commend itself. For example the SVY approach envisages the existing universities providing teaching functions via online technology. In this regard the university research component is not at the forefront of the initial development, and the SVY does not appear to be paying for the research component of the staff salaries, rather their home institutions will pay for and receive the benefit of the research activities of these staff, apart from the research benefits that get incorporated into their teaching.

The nature and cost of the research component in the University of Australia Online is not clearly defined in the available documents (Beazley, 2001a, 2001b). However, the proposal appears to downplay research activity, except in signalling a welcome establishment of an Institute of Online Teaching, with the dual roles of research and dissemination of information about effective online teaching, learning and course design (Beazley, 2001a). However, if either the SVY or the UAO were to ignore the virtual research dimension (recent personal communications indicate Finland will address it in the near future), they risk missing a unique opportunity for opening up new fields of research as well as creating new collaborative structures for research. For example, Birnbaum (2000) describes how psychology research can address and benefit from the Internet communications environment. Similar examples could be drawn from other fields, for example, the main impetus for developing the World Wide Web, HTML, and graphical interface browsers was to facilitate collaborative high energy physics research.

Cost Savings in Virtual University

One of the main drivers for moving into virtual or online university provision is to lower the cost of university education (Beazley, 2001b; Cunningham *et al.*, 2000; Elkner, 2001). Let us examine how this relates to the planning of the SVY and UAO. The chair of the Finnish university rectors association, a key figure in promoting the idea of the SVY venture, Paavo Uronen, listed the benefits of an effective SVY as providing:

- freedom from place and time restrictions;

- flexible programs and better opportunity for individual elective subject study;
- international exchange of learning content;
- coordination and synergy in content creation;
- savings in space; and
- effective use of time (e.g. between semesters, etc.).

(translation by author, URL: http://www.virtuaaliyiopisto.fi/arkisto/puheuronen18012001.html)

In the case of the SVY only one of the envisaged benefits relates to savings. It is assumed there are savings of space, presumably space used by on-campus students for learning, recreation, sporting, cultural, etc., activities. What is significant in the SVY plan is that the savings are not expected to come from the creation of content, in fact Uronen mentions in the same inaugural speech that the experience of the best Finnish and overseas universities in online learning provision indicates significant resources are required to produce effective web-based learning materials. Chipman also argues that the experience of the (online) University of Phoenix indicates the cost of good quality online provision may even be higher than normal on-campus education (Chipman, 2001).

Thus, rather than naively assuming virtual or online universities will produce cost savings in all aspects of educational provision, the Finnish planners have identified some possible savings in the bricks and mortar area, but are also prepared to approach the cost of quality content development in more realistic terms than most virtual delivery enthusiasts, and realise that it may cost the same or even more than conventional course preparation. This is a refreshing approach to the costs of virtual universities, where rather than treating virtual, online or distance education provision as a money saver across the board, a more realistic approach to the learning provision is taken with an appropriate commitment to quality. The possible areas of money saving are more clearly identified, but the likely greater costs are also recognised and included in the basic planning process.

In the University of Australia Online context the cost savings are addressed realistically in terms of the start-up costs, both in terms of UAO itself and the needs of the universities providing course materials for the UAO, but without specific amounts being listed yet, and with the hope that economies of scale will help to reduce average costs per student. National aggregation of unviable small student groups via online course provision is also expected to enable less popular courses to survive (Beazley, 2001a). One of the key provisions of the UAO proposal is a reduced HECS fee rate, but with supplementation from the government to ensure the course providers are not disadvantaged. However, for this approach to be effective usually requires large student groups for the courses, e.g. in information technology and business, but it is precisely in these disciplines we can expect to meet considerable high quality, low cost online competition from international providers, such as India, and high visibility brand name, high cost competition from USA (Hilsberg, 2001). Thus, some of the UAO costing assumptions may not stand the test of implementation. Adopting the more realistic Finnish approach to costs, would reduce the likelihood of implementation disappointments at UAO.

Virtual University Response to Fast Knowledge Change

Many commentators argue that the nature of a modern university needs to be shaped by the fast changing knowledge (Elkner, 2001; Spender, 2001). It appears that conventional education provision is not able to provide the speed of response to learning and training needs of the modern society. Thus online or virtual learning providers have an opportunity to fill the yawning gaps with quickly developed or repurposed learning content (Elkner, 2001; Llwellyn, 2001). Virtual or online learning institutions are assumed to have the capacity to meet emerging needs faster than conventional universities. However, my experience of teaching in both on-campus and off-campus modes, utilising both conventional distance education materials and innovative communications technologies indicates that change and response to emerging needs may actually be slower.

It all depends on the process employed, rather than on whether we are talking about on-campus vs. off-campus modern communications technology-mediated educational contexts. If the process involves the development of new materials with good quality educational design, employing appropriate online development, sufficient time needs to be taken to plan, design, develop, evaluate and revise learning materials that can be used by students who do not have as easy access to support by tutors or peers as on-campus students (Doube, Kennedy, & Tuovinen, 2001). The design and actual implementation of good independent learning educational design is not a trivial affair, nor is it achieved as quickly as handout development for on-campus classes with substantial local support in the form of lecturers and tutors (Rowntree, 1994). The development of materials for independent and remote learners is frequently much more time-consuming process than course materials preparation for conventional university education.

However, if the nature of the enterprise for producing new learning materials was streamlined, e.g. by deploying the development staff fully on development tasks during content development periods, rather than expecting them to be involved in other activities as well, such as on- or off-campus teaching or research, providing them with appropriate training in relevant techniques and systems, sufficient dedicated support by educational designers, media developers, etc. who are solely dedicated to specific projects rather than having to fit new developments into already crowded work schedules, modularising the content, and providing them with suitable tools and content repositories with appropriate metadata organising systems (Elkner, 2001; Llwellyn, 2001), one could hope to speed up the content creation and maintenance processes. Thus this is not only a question about the online/ virtual nature of delivery and interaction vs. on-campus provision, but as much a question of the organisational processes underlying the delivery.

It appears SVY is seeking to develop the processes for content creation that will allow it to rapidly meet the needs of the potential students. However, the size of the group envisaged to be involved in content creation appears to limit the speed of action. The SVY is intending to create virtual content along discipline lines. This means all the departments in a given discipline in the participating universities will work together to create the relevant content. For example, all Finnish university departments offering physics will decide how they develop and teach the SVY physics courses. This number of players in the development team may slow down the process, unless some efficient methods for decision making and development are adopted very early in the process.

The issue of mechanisms to ensure speedy addressing of emerging educational needs has not been discussed in the current University of Australia Online context. Presumably the independent nature, dedicated purpose and support from the integrated Institute of Online Teaching are expected to free the organisation from on-campus teaching and research distractions and allow it to work solely on the online teaching preparation and delivery. However, the nature of the course materials preparation, which is expected to involve the UAO itself, other universities as well as commercial partners, appears to be so complex that the coordination process may swallow up many of efficiencies gained from the independent nature of the structure. There does not seem to be the same degree of inter-organisational collaboration, and consensus input in materials development in the UAO as in the SVY plans. The benefit of this is that with less people to consult the process should work more quickly, but with reduced input the products may not incorporate as large a range of informed perspectives.

Organisational Collaboration

This brings us to the issue of organisational collaboration, which is a key issue in the Finnish Virtual University project, and in any collaborative project. We will discuss some examples of off-campus education that appear to be relevant to virtual university enterprises.

Let us begin with the case of the University of Mid-America. This was an attempt to create an open university in USA based on a traditional university base but utilising television and radio to provide much of the educational delivery. In the 1970s to early 1980s the president of the University of Nebraska and the general manager of the Nebraska educational television network gathered together a significant collection of institutions from that region to a consortium, whose activities were seeded by the US federal government, to develop a distance education university using the latest educational technology (McNeil, 1993). The program developed excellent learning materials, and enrolled 20,000 students in the seven states represented by the member universities and another 20,000 outside their geographical area.

However, the consortium failed. When the federal seed money ran out, the consortium folded. McNeil (1993, p. 124-126, 129-130) cites the following reasons for the failure:

- inadequate funds for production and distribution;
- confusion about the mission of the consortium;
- funding of the consortium from the outside instead of by members;
- difficulty in accepting learning content produced outside own institutions, i.e. 'it wasn't made here' syndrome; and
- conservatism and resistance to change by the university community.

His conclusion is salutary:

> For a state, a university, or a school system to engage in a co-operative venture, each member must gain something from the exchange. And those 'somethings' have to be more than window-dressing. They must have substance. They must be worthwhile. Members in a consortium also must realize that participation is going to have a cost – either cash or staff support. Like other organizations, consortia do not operate for nothing. In addition, consortium members have to agree to give up some autonomy and responsibility in the designated activity area. No consortium is worth its salt if it deals only with problems that everyone agrees upon. Consensus is desirable but, in many cases, the consortium cannot afford consensus-only decisions.

He developed seven key questions for institutions intending to join in collaborative ventures:

1. What are the consortium's objectives?
2. Whom should the consortium serve?
3. What structure will be needed to manage the consortium?
4. What new policies will be needed to manage the consortium?
5. What involvement will faculty and students have in managing the consortium?
6. Who will set priorities for the consortium?
7. What will the consortium cost in hard cash, staff support and time?

These questions pinpoint the minimal success quantum. If satisfactory answers to these questions cannot be found in the consortium planning and practice, the collaborative activity is in grave danger. This is not to say that satisfactory answers will guarantee success, but unsatisfactory answers will almost certainly lead to failure.

The second example we could consider is Open Learning Australia. This brave new collaborative venture conceived in 1993 was intended to provide distance education to Australia at a lower cost than from the conventional sources. Economies of scale were expected to provide cheaper course provision. For example many institutions intended to provide partial courses via OLA to lead the students into their existing distance education courses. The expected economies of scale also were expected to arise from multipurposing existing distance education materials since they would not need substantial extra work to deliver via OLA (J. Beck, personal communication).

Broadcast television was seen as one of the main communications mechanisms of OLA. However, even though it has been a good advertising medium for Open Learning, including providing people a free taste of the courses, because of finance restrictions on making good quality educational television programs, it has not been used as the main channel.

Due to cost and other pressures on the initial consortium a new consortium with shared ownership by seven institutions was negotiated. This consortium has now developed a successful distance education provision model, including a suitable business model for its operation, and is providing more than 300 units of study leading to 51 courses from 27 universities or colleges.

As a third example I shall consider is the ANTA Toolboxes project (online). The Toolbox project arose out of the Australian TAFE community realising the individual members could not sustain the cost of high quality learning resource development. Acting independently to produce new high quality resources, with suitable learning strategies and support materials was not feasible. Instead they decided to redirect some of their funding from other projects to collaborative resource development (Oliver *et al.*, 2001). In doing this they have maintained control of the process by setting up a representative Project Steering Group within the context of the Australian Flexible Learning Framework established by the EdNA VET Advisory Group (EVAG). The Project Steering Group comprises senior flexible learning managers from several states and territories, and representatives from ANTA, DETYA, etc. Its six-weekly meetings determine policy issues relating to toolbox development, the selection of projects and the evaluation of project outcomes. This ensures the resources developed are of the highest possible quality, but made available at an affordable cost to the participants and the funds are spent on resource production directly benefiting members' teaching functions. For example the cost of producing a single "toolbox" might be in the $100,000s, but the resulting materials will then be available for only few hundred dollars (http://www.flexiblelearning.net.au/toolbox/series1/describe.html).

These last two examples indicate some key aspects of collaboration in the provision of online/ virtual education. Firstly, both of these consortia have clear benefits to gain from the activities. Secondly, they have both been willing to contribute sufficient resources to the activities to make them work in practice. The original funding for OLA units was so low that it discouraged some of the established distance education providers from developing suitable offerings. In particular, the funding was far too limited to allow the main television communications medium to be used effectively by all the participants (J. Beck, personal communication). In the negotiation of current consortium arrangement these issue were known and understood more clearly by the participants and more realistic unit development and delivery mechanisms and costings were used as the basis of the agreement.

These aspects of collaboration in the Virtual University of Finland project are currently under negotiation and so their model is not mature enough to provide guidance for the collaborative operational aspects of other equivalent programs. Secondly, even if an exemplary collaboration model was already in place in the SVY model, it has not been in practical operation for long enough for that model to be tested and produce results to indicate the value of their approach.

The nature of collaboration in the University of Australia Online model is represented schematically in Figure 1 provided in the ALP Policy Paper (Beazley, 2001a).

The collaboration between the UAO and the existing universities is not very clearly spelled out, except to indicate it will work with existing universities to commission content development in the universities, and to provide assistance to them in their online teaching development via the Institute of Online Teaching (Beazley, 2001a). The model of the Australian Cooperative Research Centres is invoked in the Policy Paper to indicate the approach to 'online education industry development program' to be adopted. Although citing a well-known collaborative research approach, it is still not clear how this would work out in the context of educational online content development, delivery and maintenance. All the collaboration difficulties spelled out earlier, especially by McNeil, are yet to be addressed, and as we saw in the case of the University of Mid-America, they may be fatal flaws, or perhaps they could be resolved in practice as OLA has done. What is missing here is the ground swell from the institutions themselves to develop and set up this mechanism for facilitating online education in Australia, as in the case of the ANTA Toolboxes program. The lack of this motivation and grass roots commitment is one of the biggest problems facing the UAO.

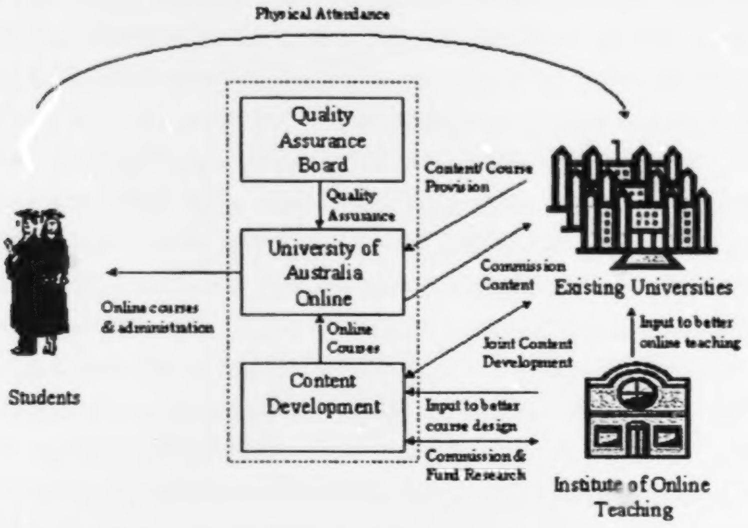
Physical Attendance
Quality Assurance Board
Quality Assurance
University of Australia Online
Online courses & administration
Students
Online Courses
Content Development
Content/Course Provision
Commission Content
Existing Universities
Joint Content Development
Input to better online teaching
Input to better course design
Commission & Fund Research
Institute of Online Teaching

Figure 1: University of Australia Online (from ALP UAO Policy Paper)

Virtual Nature of Educational Operation

The virtual nature of the Virtual University of Finland and its implications for the UAO deserves some comment. It is the online or virtual provision of education that is intended to enable the SVY to meet its critical mission objectives outlined above by Rector Uronen. The SVY notion appears to imply an online delivery of the educational program to achieve the six aims listed by Uronen. However, we could equally argue that a well-organised collaborative conventional distance education program could also deliver the same outcomes. Why then does the distance provision in the SVY (and UAO) have to be largely online?

Let us use the four interactions model developed to link together the educational interaction involved in typical distance and online education programs to discuss these issues – see Figure 2 (Tuovinen, 2000).

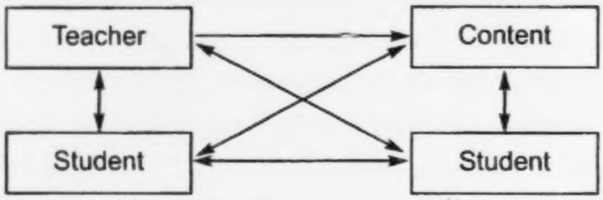
Teacher
Content
Student
Student

Figure 2: Four fundamental distance education interactions (Tuovinen, 2000)

Firstly, the organisational aspects of the materials development (*teacher – content* interaction in the above model) in SVY may not be any more virtual or online than, for example, at OLA. Both SVY and OLA are moving to create a metadata standards-based system for the development of learning objects. The key aspects in this process are the identification of the processes and standards involved in the creation, storage, and delivery of educational content. The hope of the virtual nature of this interaction is to enable the same material to be more easily shared between interested participants in the development process. Similarly the material is intended to provide reusable learning objects,

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so that the existing resources can be repurposed and reused. Both of these organisations will need to implement particular instances of metadata-based content creation systems, and until the particular systems have been developed it is not at all clear how well they would operate.

It would be expected that a similar approach would be followed by the UAO, to ensure that its operations employed the best international standards and practice. However, the existing proposals for UAO have not yet addressed this level of detail.

Secondly, virtuality in this situation can be taken to mean online interaction between the student and the content. It is not clear if the SVY or UAO are intending to enable all *content-student* interactions to be *only* in online mode, or *partly* in online mode. The expectation in the relevant literature seems to favour the use of multiple methods of interaction for content-student interaction, where online aspects are an important possible component to be used strategically by the educational designer, but where they must not constrain the selection from a wide ranging menu of communication choices (Keegan, 2000; Lockwood, 2001).

An interesting alternative in this regard is provided by the development of virtual campuses in some Australian universities. For example, Monash University initiated the Berwick campus in Victoria, as a virtual campus. The University installed large-scale interactive videoconferencing systems at a number of the existing campuses as well as at Berwick, to allow students to receive lectures from staff teaching at other campuses at Berwick as well (Jamieson, Miller, Sunderland, & Tennant, 1999).

The experiences of some of these teachers are described in a short account, entitled "Understanding teleteaching: the experience of four Monash teachers" (Jamieson, 2000). These accounts indicate that teaching in this mode is significantly different to normal classroom teaching. The teachers new to this environment need substantial preparation for the new mode, or else the whole process may be unsatisfactory.

Two Monash University staff not mentioned in this book taught Accounting using teleteaching to two groups at two campuses, Gippsland and Berwick. They interspersed teleteaching with conventional on-campus teaching over four years. Interestingly the students very much preferred on-campus teaching to teleteaching (Halabi, Tuovinen, & Maxfield, 2000), but their results from the teleteaching semesters (same content, same teachers, same amount of time, same assessment) were significantly better than from conventional on-campus classes. We have not yet finished analysing the reasons why this might be so. Thus we do not wish to make any grandiose claims for virtual campuses or video-mediate teaching, but given good quality teaching and content, teleteaching does not in itself reduce learning, and may even enhance it!

In fact, a comparative study by Katz indicates video-mediated distance teaching is superior to both Internet-based offerings and audiographic teaching approach, where the students and teacher are not able to see each other even thought they are in real-time group study sessions (1999). He found that students learnt the most from video-mediated teaching and it was their preferred mode of study out of these three options. Thus in the rush to virtual teaching, it is well worth considering video-mediated real-time interactive teaching as a major component of the delivery, instead of by-passing it for the Internet or even audio-conferencing supported by live interaction via networked computer conferencing.

On the other hand, it is clear that asynchronous online interaction can provide a very useful dimension to extending the students' interactions with their tutors and with their peers. For example, Keegan notes that in 1999 at the Open University of UK 70,000,000 emails were sent per year and 700,000,000 emails were read by students (2000, p. 15). However, this is still not an argument to suggest that *all* the *student-student* or *student-tutor* interactions should be conducted online at SVY, UAO or any other online university for optimal effect.

However, to overcome isolation, family and finance commitments (Beazley, 2001b) the *possibility* must exist for all the four interactions to be carried out completely online. Thus it should be possible for collaborative teams to produce SVY or UAO material using a common online metadata standards-based system, where the existing relevant material is available for reuse, irrespective of whether the participants are working in the same office or on the opposite sides of the globe. Similarly, the student should be able to interact with the content purely online, without using any other means or materials. Thirdly, it should be possible for the tutors and students to discuss issues and work in dynamic shared workspaces, either in real time or asynchronously, without being physically in the same place. Finally, it should also be possible for the students to work on collaborative learning projects online, without having to attend the same work space, as in the advanced design distributed workspace, 'The Studio', developed between the University of Lulea, Sweden and Stanford University, USA, which utilises shared virtual reality spaces for developing design prototypes by group members located in different places, even in different countries (online).

Conclusion

This brief comparative discussion of the Finnish plans for a collaborative virtual university and the Australian Open University proposal has sought to examine the nature of such an enterprise by considering the nature of a modern university, the underlying collaborative structure and some aspects of virtual/ online operations. Both proposed institutions will need to wrestle with the teaching/ research roles in an online environment. The assumed cost benefits in the UAO model may be harder to realise than the more realistic SVY plans. It appears the Finnish and the UAO enterprises may meet similar challenges to OLA in its early days, especially in terms of contributions to the shared enterprise by fiercely independent universities, who find it difficult to agree on credit transfer, let alone funding operations they do not fully control. However, such an enterprise can take advantage of the metadata-based online systems developed for content tagging, storage and reuse for more efficient content development.

The assumptions about online/ virtual universities using only Internet for educational interactions in their programs needs to be reconsidered in light of recent findings about the value of video conference-mediated education. Similarly developments in mediating virtual reality learning environments online form a very promising opportunity for student-content, teacher-student and student-student interactions for virtual universities beyond the capabilities inherent in the SVY and UOA plans.

The structures expected to provide the speedy curriculum development, the timely responses to students and community educational needs still need substantial work. However, the Finns are fortunate in having very experienced operators on their implementation committee, and also are able to draw on the resources of the national supercomputing centre (CRC), e.g. in the development of the unified portal to the SVY. The telecommunications infrastructure based on the FUNET network is excellent, and the technical capacity of the Finnish companies to support the enterprise is second to none.

Similarly the UAO implementation can also draw on many local resources. Australia has a long history in distance education, with extensive experience in collaborative off-campus education provision via the OLA, collaborative resource development in the ANTA Toolboxes and collaborative research between multiple universities and industry groups in the CRC program.

Thus it will be interesting to see if the collaborative organisational hurdles and other challenges can be overcome to make SVY the Nokia of the virtual university world and UOA another BHP success story.

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HOW TO IMPROVE CRITICAL THINKING USING EDUCATIONAL TECHNOLOGY

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Abstract

Critical thinking is highly valued but difficult to teach effectively. The Reason! project at the University of Melbourne has developed the Reason!Able software as part of a general method aimed at enhancing critical thinking skills. Students using Reason!Able appear to make dramatic gains. This paper describes the challenge involved, the theoretical basis of the Reason! project, the Reason!Able software, and results of intensive evaluation of the Reason! approach.

Keywords

critical thinking, reasoning, argument, practice, transfer, argument maps, evaluation, pre and post-testing

The Problem

Critical thinking is one of education's most central goals and one of its most valued outcomes. Mission statements routinely aspire to cultivate critical thinking as a core intellectual virtue. And so they should. Fundamentally, critical thinking is just exercising the general forms of thought most conducive to sorting the true from the false – or, more bluntly, "the art of being right." Thus critical thinking is, as the Enlightenment philosophers understood, central not only to intellectual progress but to all forms of social progress as well.

Unfortunately, critical thinking is in short supply. This is apparent from informal observation. As Einstein put it: "Only two things are infinite, the universe and human stupidity, and I'm not sure about the former." Einstein's despair has been supported by detailed empirical studies. In her landmark book *The skills of argument* (1991), psychologist Deanna Kuhn reported intensively studying hundreds of people from all walks of life. She found that over half the population cannot reliably exhibit even the most basic skills of general reasoning and argument. More recently, a DETYA-commissioned study concluded that "employers *value* this skill and *can* find it, but it is *rare*" (Nielson, 2000).

If something is both valuable and rare then we should try to produce more of it. In the case of critical thinking, this is rather difficult to do. There are two standard strategies. One, the indirect strategy, is to expect that students will just pick up critical thinking skills in the course of their studies. Thus the Arts Faculty at the University of Melbourne, which has been referring to itself as "The Critical Faculty," tries to cultivate critical thinking by requiring its students to study politics or English or history. In general, the indirect approach does work, but only slowly. According to the leading specialist in this area, Ernest Pascarella,

> Our best estimate is that the first three years of college [i.e., undergraduate studies at university] provide an improvement in critical thinking skills of about .55 of a standard deviation or 20 percentile points. (Pascarella, in progress).

On a semester-by-semester basis, gains of this magnitude are pretty slight. Consequently there have been many attempts to accelerate the process by teaching critical thinking directly. Most notably, there are the subjects taught every year in philosophy departments going by names such as "Critical Thinking" or "Introductory Logic." Here critical thinking is the content as well as the intended outcome, and one would naturally expect to see hefty gains. Insofar as these subjects have been empirically evaluated, however, they have been equally disappointing (van Gelder, 2000). According to Pascarella,

> Evidence suggests that critical thinking can be taught, although the average effect is based on a rough estimate and is quite modest in magnitude. Students who receive purposeful instruction and practice in critical thinking and/or problem solving skills appear, on average, to gain an advantage in critical thinking skills of .23 of a standard deviation (9 percentile points) over students not receiving such instruction. (Pascarella, in progress).

Average gains of this amount are difficult, if not impossible, for ordinary people to sort out from statistical noise. Many teachers of critical thinking suspect that their efforts are making little if any difference. Doug Walton, a leading informal logician and teacher of critical thinking, wrote recently:

> I wish I could say that I had a method or technique that has proved successful. But I do not, and from what I can see, especially by looking at the abundance of textbooks on critical thinking, I don't think anyone else has solved this problem either. (Walton, 2000).

The Quality Practice Hypothesis and the Need for Computers

Quality Practice

So critical thinking is valuable, rare, and hard to teach. Recognising this problem, the Reason! project at the University of Melbourne has been developing a whole new approach. Rather than tinkering with existing methods, we are building afresh from solid foundations in cognitive science. Reviewing the research literature on cognitive skill acquisition, we found a consensus around the unsurprising idea that cognitive skills, like other skills, improve with practice. However, it must be the right kind of practice. Generically, the practice should be

- *Motivated* – the student should be deliberately practising in order to improve skills
- *Guided* – the student should have some way of knowing what to do next
- *Scaffolded* – particularly in early stages, there should be structures preventing inappropriate activity
- *Graduated* – tasks should gradually increase in complexity
- *Feedback* – the student should have some way of telling whether a particular activity was successful or appropriate

(See Chase & Simon, 1973; Dreyfus & Dreyfus, 1986; Ericsson & Charness, 1994, Ericsson & Lehmann, 1996; Voss, Wiley, & Carretero, 1995). Further, the practice should be suitably *general* in nature. This is a subtle matter. The greatest challenge facing attempts to inculcate general thinking skills is the problem of transfer: skills acquired in one domain or context often do not carry over to other situations. For example, training in formal reasoning (e.g., chess, mathematics, formal logic) yields little benefit outside those domains. To beat the problem of transfer, critical thinking practice must be not merely practice in some situation or other, and not merely practice in a wide variety of situations, but practice in *transfer itself.* That is, students must practice transferring concepts and skills initially experienced in one situation over to a wide variety of other contexts or domains.

We use the term "quality practice" for practice-for-transfer with the generic properties listed above. The "quality practice hypothesis" (QPH) is the conjecture that critical thinking skills improve substantially through, and only through, extensive quality practice.

Situated Cognition?

It is worth mentioning that the QPH directly conflicts with the "situated cognition" perspective on cognitive skills. At least in its more extreme incarnations, this school of thought maintains that there are really no *general* critical thinking skills, and it is pointless to try to teach such skills in the classroom. Rather, all thinking is tied to particular concrete situations; learning doesn't transfer to remote contexts; training on abstract principles is of little use; and learning should take place in complex social environments (see, e.g., Lave, 1988).

This perspective is supported by various kinds of evidence, including the disappointing results of attempts to teach critical thinking (see previous section). Yet it stands soundly refuted insofar as there are unambiguous examples of people acquiring and exhibiting general critical thinking skills. Kuhn (1991) points out that at least some people (in her study, it was graduate students in philosophy) do show flawless general reasoning skills. Further, our work (see below) shows that general critical thinking skills *can* be substantially enhanced in the classroom. The extreme situated cognition position is therefore false. This does not mean there was nothing of value in the broadly "situated" camp; indeed, it offers many valuable insights into the challenges involved in improving general critical thinking skills.

Computers to the Rescue

The QPH, if true, poses an enormous problem. Quality practice appears to require close supervision from an expert coach to help provide the motivation, guidance, scaffolding and feedback students require. However we can't afford to provide such coaching, except at the Australian Institute of Sport. Realistically, the most we can expect is one teacher – who may not be an expert – for every 20-30 students. This is not nearly enough. It thus appears that if the QPH is correct, we will never be able to improve critical thinking substantially on a large scale.

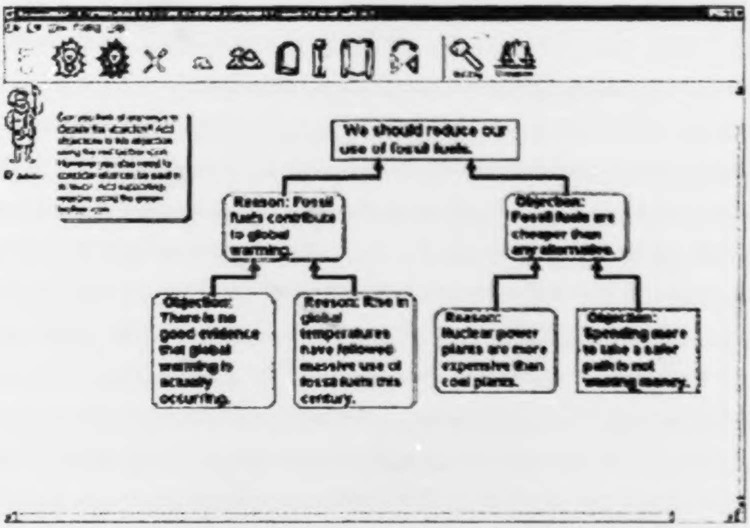
We can think of only one practical way to attack this problem. It is to use computers to help the student, and to help the teacher help the student. It will be impossible, for the foreseeable future, to replace the expert human coach with a computer program. However computers can assume some of the burden of guidance, scaffolding and feedback, so that student practice activities are better quality and the teacher's input has greater effect.

The Reason!Able Practice Environment

Over the past four years we have been developing the Reason!Able software as an environment in which students can do a better grade of practice and thereby improve their reasoning. Reason!Able is a stand-alone Windows program in which students are guided and scaffolded through the complex processes involved in representing and evaluating reasoning on any topic.

One key innovation in Reason!Able is that all reasoning activities are conducted in specially-designed flowchart-like diagrams called argument maps or trees. Reasoning is essentially a matter of working out the logical or evidential relationships among claims. An argument map is a graphical presentation of reasoning in which the relationships among claims are made visually explicit. Figure 1 shows Reason!Able displaying an argument map of a relatively simple piece of reasoning on the topic of fossil fuel use. The various claims are entered in boxes placed on the workspace. The relationships between the claims are signified by three graphical properties:

- **Lines**. A line between two boxes indicates that one is evidence for or against the other
- **Relative position** in 2D space. If one claim is evidence for or against another, they will be appropriately juxtaposed.
- **Colour**. Green indicates a reason (supporting evidence); red indicates an objection (opposing evidence).



We should reduce our use of fossil fuels.

Reason: Fossil fuels contribute to global warming.

Objection: Fossil fuels are cheaper than any alternative.

Objection: There is no good evidence that global warming is actually occurring.

Reason: Rise in global temperatures have followed massive use of fossil fuels this century.

Reason: Nuclear power plants are more expensive than coal plants.

Objection: Spending more to take a safer path is not wasting money.

Figure 1: Reason!Able 1.03b screenshot showing an argument map of some simple reasoning on the topic of fossil fuel use. "Socrates" is offering advice in the upper left hand corner.

Using these conventions, a Reason!Able argument tree presents a structure of reasoning in a completely explicit and unambiguous fashion.

Reason!Able argument trees are not static and pre-given. Rather, they are built up by the student herself, who types text into claim boxes and places the claims on the argument tree. The tree structure is manipulable to allow easy reformulating of the reasoning. Thus claims and even whole branches can be torn off the argument tree, or added on at any point, or dragged and dropped to another location.

Reason!Able is designed to be used by novices who have had no prior instruction in the general principles of reasoning and argument. The goal is to help such people gradually acquire the relevant concepts, procedures and skills. Thus there is ever-present context-sensitive guidance. Whenever the student clicks anywhere on the argument tree, the "Socrates" character prompts the student to think about issues pertinent at that point. In Figure 1, the student has clicked on an objection to an objection (i.e., a rebuttal). Socrates is asking the student to consider whether she can dispute the objection – or alternatively, whether she can back it up with evidence.

Developing arguments is an important aspect of critical thinking. Another equally important aspect is evaluating, i.e., determining whether a given argument – particularly an argument you have just developed yourself – is any good. Reason!Able also guides and scaffolds the student through the processes involved in evaluation.

Thus the program has two basic modes of operation: "Building" mode, in which reasoning is articulated, and "Evaluation" mode, in which arguments are assessed for quality. Students switch back and forth between the two modes at any time, using the hammer (build) and scales (evaluate) icons. In evaluate mode, clicking once on any node will cause Socrates to proffer pertinent advice. Double-clicking brings up a dialog allowing the student to enter her considered evaluative judgements. Information about how to make such judgements is available by clicking on the Help button on the dialog. This calls up the relevant page of an extensive Help section, which amounts to an in-built mini-textbook on the theory and practice of informal reasoning and argument.

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This brief overview has presented only the most obvious and simple aspects of the software. Other features include:

- Reasons and objections can be "unfolded" to reveal the internal structure of premises (main premise and co-premises or assumptions), with reasons or objections targeted upon specific premises.
- Individual premises can be evaluated for truth, in terms of the relevant reasons or objections, as well as basic "grounds" such as common knowledge.
- The program supports various viewing modes to help users comprehend of complex arguments.

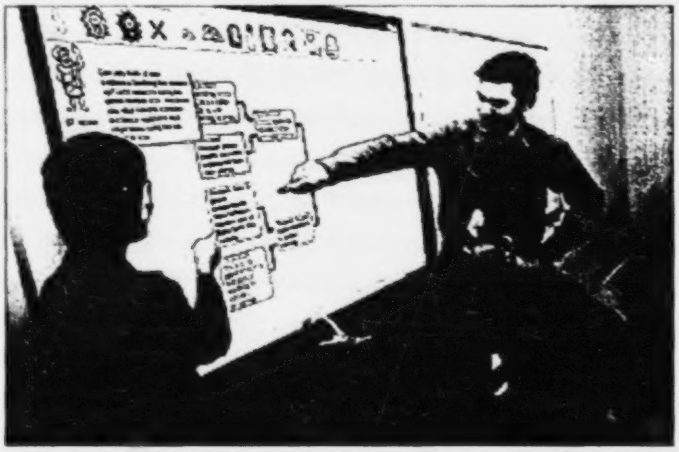

Figure 2: Reason! project members using Reason!Able. The image is projected on a "smartboard" – a touch-sensitive whiteboard allowing many operations to be performed by using a finger instead of the computer's mouse or keyboard. In this image one team member is about to drag a reason box to another location. Using Reason!Able with this technology helps make abstract arguments into concrete, manipulable structures.

Quality Practice in the Reason!Able Environment

Reason!Able is designed to support quality practice. Students practice two main kinds of critical thinking activities using the package. *Critical evaluation* is identifying and then evaluating the reasoning provided by somebody else in some text (e.g., an opinion piece, journal article or book). In *argument production*, students develop their own reasoning to support their own positions. Both activities involve putting together an argument tree representing the reasoning, and then systematically assessing that reasoning. These procedures are much more complicated than most people realise, with an intricate recursive structure.

Reason!Able helps improve the quality of student practice by comparison with ordinary practice activities such as classroom discussions or essay writing. It does this in a number of ways.

1. **Guidance**. Most obviously, Reason!Able provides continual, context-sensitive guidance in the form of promptings from Socrates. Students can "ask" for instructions simply by clicking at any time at any point on an argument tree. Obviously Socrates' "canned" guidance is never going to be as good as advice from a genuine human expert. However it is better than nothing, and may well be better than attempted advice from a human non-expert. And over time we hope to gradually introduce AI techniques to help Socrates become a bit more intelligent. Note also that with experience, students find they can anticipate what Socrates will say and find his always popping up a bit irritating, so they switch off his advice. That's the whole idea; students are then providing their own guidance because they understand roughly what to do.

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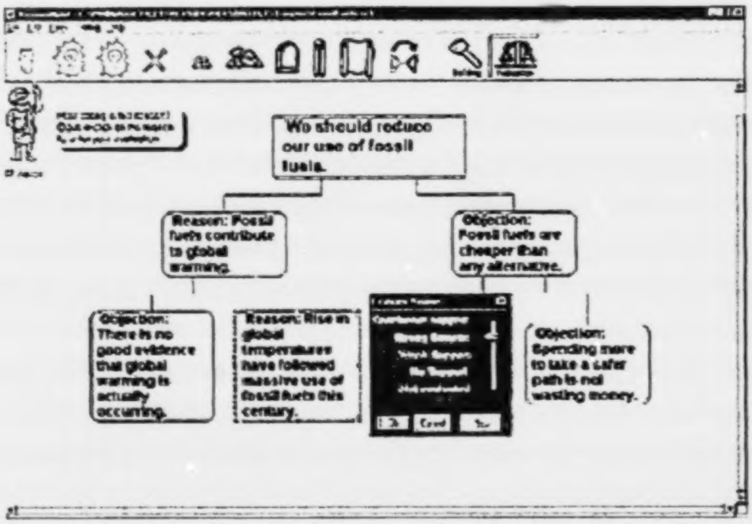

We should reduce our use of fossil fuels.

Reason: Fossil fuels contribute to global warming.

Objection: Fossil fuels are cheaper than any alternative.

Objection: There is no good evidence that global warming is actually occurring.

Reason: Rise in global temperatures have followed massive use of fossil fuels this century.

Objection: Spending more to take a safer path is not wasting money.

Figure 3. Reason!Able in "evaluate" mode. Students are prompted to enter their own judgements as to the quality of the reasoning. In this case the user is evaluating one reason as providing strong support (bright green) for another (white). Evaluations should be, but might not be, correct or appropriate. Note that all other parts of the argument tree have receded into the background since they are not relevant to the quality of the selected reason The result, when all steps in the process have been completed, is a simple visual representation of a developed argument plus the student's evaluation of the quality of the reasoning.

2. **Scaffolding**. Just as importantly, Reason!Able provides very strict scaffolding for students' thinking. Using Reason!Able, students can *only* create "syntactically" correct argument maps. They rapidly learn that an argument has a main conclusion, and a hierarchical structure of reasons & objections, themselves made up of claims, and so forth. This scaffolding puts strong structural constraints on the way they think about issues and formulate their reasoning. This is a key advantage of Reason!Able over more flexible or free-form frameworks for representing reasoning such as prose or generic diagramming packages such as Inspiration. An added advantage of this approach is that all students in a group are scaffolded to have the *same* understanding of the structure of reasoning, making for more productive communication.

3. **Feedback**. Reason!Able on its own does not provide any significant feedback on the user's activities. Basically, this would require the program to be intelligent enough to understand language and reasoning, and this level of sophistication is currently far beyond the frontiers of computer science. Crucially, however, Reason!Able does provide a context in which students and teachers can generate better feedback than would otherwise be possible. For example, in critical evaluation tasks students can develop their own answers and then compare them with models. Since Reason!Able argument maps represent information in a simple and accessible fashion, students can directly compare their treatments with the recommended answers. By noting differences, and assuming the model answer is correct, students are generating their own positive feedback (when they are in alignment) and negative feedback (when there is a difference). Similarly, when teachers examine students' argument maps, they can see at a glance what students are thinking, and provide more rapid and targeted feedback than is possible in traditional forms of interaction (such as commenting on a piece of written work).

4. **Motivation**. Reason!Able appears to help improve enthusiasm for practice. Many students find Reason!Able's simple, colourful diagrams more appealing than dry prose. Also, the

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> guidance, scaffolding and improved feedback help them feel that they are making more concrete progress than in more flexible environments, where seems that "anything goes" and students can feel that they are floundering.

The remaining two dimensions of quality practice are (a) graduated exercises, and (b) practice-for-transfer. Reason!Able alone does not enhance these dimensions. It is up to the teacher to provide a suitably graduated and diverse exercise regime.

Does the Reason! Approach Work?

From the outset we have been aiming to develop an approach to critical thinking instruction that *demonstrably* produces *substantial* gains. (A further constraint is that the approach be practical and affordable for widespread use.) The new approach is the Reason! method, which essentially just implements the QPH with Reason!Able as the practice environment. In order to determine the extent to which the Reason! method really works, we have been pre- and post-testing students using the method. This also gives us indirect insight into whether using Reason!Able actually helps students improve their critical thinking.

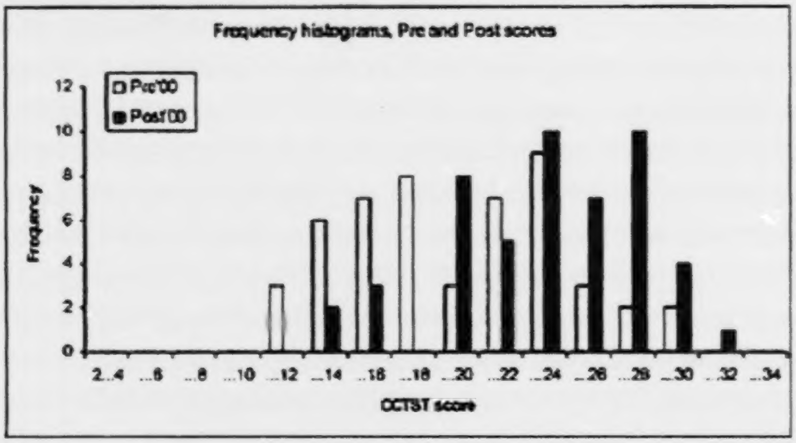

Figure 4: Gains in critical thinking over 12 weeks in 2000 using the Reason! approach, as measured with the California Critical Thinking Skills Test. The distribution of scores shows a substantial upward shift from the pre-test (light blue) to the post-test (dark blue).

Evaluation Method

The context is the University of Melbourne undergraduate subject Philosophy 161003 *Critical Thinking: The Art of Reasoning*. In this subject, students are intensively trained in critical thinking using the Reason! method. We estimate gains in critical thinking by pre- and post-testing using two different tests. The first is the California Critical Thinking Skills Test, probably the best objective (multi-choice) test, and increasingly widely used around the world. The other test is a written task of our own devising, loosely based on the Graduate Record Exam's Writing Assessment. Here students are given a short argumentative text, and are asked to identify and evaluate the reasoning. The written test is scored by two critical thinking experts who are quite independent of our team. They grade "blindly" in the sense that we take all possible precautions to conceal whether any given answer is from the pre-testing or a post-testing. They are given some instructions, but we keep the guidance minimal because we want their independent (and possibly quite different) perspectives on whether critical thinking has been improved. Both tests have two forms and we use a crossover design. Using this design, our evaluation processes are, to our knowledge, the most intensive and rigorous ever deployed to evaluate the efficacy of an attempt to improve critical thinking.

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Results

Data is available for studies conducted in both 2000 and 2001. The two studies yielded essentially the same results. The CCTST indicated improvement with an effect size of about 0.84 (mean difference between paired pre- and post-test scores, divided by standard deviation on the pre-test). The written test showed effect sizes of a similar order of magnitude, though there were substantial differences and low correlations between scorers. Collectively these results indicate that the effect is quite robust. Crudely speaking, we are seeing a gain in critical thinking of the best part of one SD in a single semester. (For comparison, an equivalent shift in IQ would be about 12-13 points on average across the group.)

Reason! Approach Versus other Approaches

This is, to our knowledge, the largest gain ever recorded anywhere over a comparable period or for a comparable intervention (see van Gelder, 2000 for an overview of all relevant studies). The Reason! approach appears to significantly outpace other "direct" attempts to teach critical thinking (Figure 5), and appears to dramatically accelerate improvement in critical thinking when compared with the "indirect" strategy (i.e., just being at university) (Figure 6).

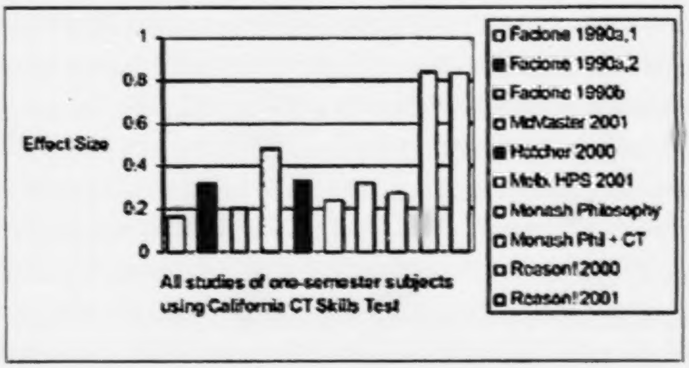

Figure 5. All known CCTST studies of gains in critical thinking in the context of a one-semester subject. This illustrates that the Reason! method is roughly tripling the gross gains of typical one-semester critical thinking subjects. Hatcher (2000) is a two-semester study, pro-rated to one-semester. The next best performance, after the Reason! approach, is McMaster 2000 (unpublished), which was also software-based, though it used a very different package. The latter five studies, including the two Reason! studies, were performed by us and have not yet been published elsewhere.

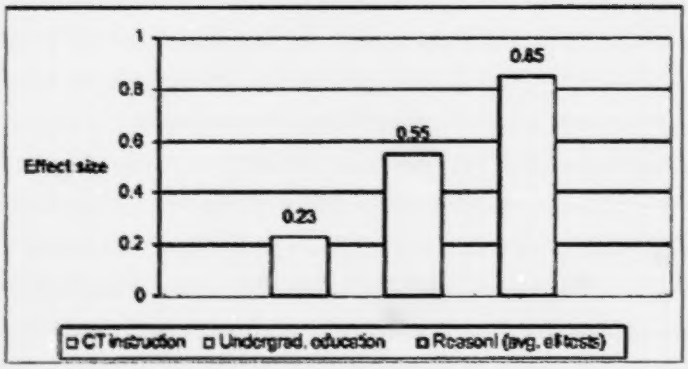

Figure 6. Gain in critical thinking skills, comparing the gain using the Reason! method with standard critical thinking subjects, and the effect of being at university. This comparison suggests that the Reason! method is about three times as effective as standard critical thinking courses, and more effective than three years of undergraduate education.

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Effect of Reason!Able

None of this establishes that using the Reason!Able software itself helps improve critical thinking skills. Reason!Able is one element of a total package which includes many other factors which may be causing improvement, such as the :

- intensive practice involved in the Reason! method;
- nature of the practice activities involved;
- particular skills of the instructor(s) involved in teaching 161003; and
- "founder's effect" – the unusual level of enthusiasm and energy shown by the instructor(s).

The substantial gains in critical thinking shown by our students *could* be caused wholly or in large part by these other factors, either individually or in combination.

In theory, to accurately gauge the Reason!Able's distinctive contribution to learning, we would need to compare two courses, equal in all respects other than use of Reason!Able, and with randomised assignment of students to one course rather than another. In practice, this kind of experimental situation is very difficult to arrange. However, although we can't accurately say *how much* benefit Reason!Able confers, it is plausible that the software is making a substantial contribution. After all, it was designed in order to make possible and practical the kind of activity which, according to cognitive science, should enhance general critical thinking skills. Second, students in course evaluation questionnaires agree that the software helps them learn.

In current and future studies, we are attempting to eliminate or at least assess the impact of confounding variables. Additionally, we are trying to obtain a higher level of insight into (a) the QPH, and (b) the benefits of using Reason!Able. The software now records extensive data each student's practice activities, and uploads that data to a central repository. We will be able to process that data together with the improvement to see if there are interesting correlations between use of the software and improvement. Certain patterns of correlation would provide strong evidence both that the QPH is true and that Reason!Able use does contribute substantially to critical thinking skill.

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THE RELATIONSHIP BETWEEN THE PERCEIVED VALUE OF SUPPLEMENTARY ONLINE COMPONENTS, AND STUDENT ROLES AND RESPONSIBILITIES

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Abstract

Online delivery is becoming more widely used to enhance face-to-face provision within the tertiary sector. What is the value of such supplementation in the learning process? This notion of value is explored through examination of the responses and online output of over 50 students involved in two 3rd year units, each of which used online supplementation. These responses and output are then analysed within teacher-centred and student-centred models of teaching. The findings suggest that the level and amount of self-directed learning undertaken by the students in the supplementary online component is related to the approach to teaching and learning adopted by the lecturer.

Keywords
student-centred teaching, self-directed learning, online supplementation

Introduction

Universities throughout Australia are embracing the call for increased flexibility in learning through the provision of online course delivery. Online delivery can include various types of provision including: that ranges online that supplements to face-to-face or print-based provision; that substantialy replaces replacement of part of a face-to-face or print-based course and online provision that is that which is the primary means of course delivery (Harasim, Hiltz, Teles & Turoff, 1995). In many courses in Australia, a supplementary provision is used. In what ways can this supplementation provide added value to face-to-face teaching?

In examining the value of any online mode of delivery, it is important to consider some universal principles that underlie teaching and learning, and their subsequent implications in practice. Teaching, in whichever mode, should aim to improve the quality of student learning, where learning is defined as developing increasing levels of understanding including basic knowledge acquisition, application, integration of ideas, abstraction of meaning, and ultimately reconceptualising and viewing the world differently (Gibbs, 1992). A major pedagogical approach to improving student learning is that of "student-centredness" and one of the claims made of online provision is that it is "student-centred" (Berge & Collins, 1995; Kearsley, 2000)

However, to be student-centred in any mode of delivery, certain teacher and student behaviours need to occur. For the teacher, these include organising the subject matter and assessment so that:

- they have relevance and meaning for the learner;

- students can become involved in their learning; and
- the teacher can facilitate learning at all levels (Brandes & Ginnis, 1986).

For the learner, there are also responsibilities. These include:

- taking ownership of the learning; and
- participating (Brandes & Ginnis, 1986).

In the face-to-face context, student responsibilities and management of their time can be carefully supported and scaffolded by the teacher. But with the flexibility offered by the online environment, students need to be far more self-directed in the responsibility they take for their learning. Depending upon the course and materials, they need to be able to independently:

- decide what knowledge and skills they need to learn;
- locate suitable materials;
- adopt those learning strategies that help them to better understand;
- find time for learning; and
- decide where they will learn (Merriam & Caffarella, 1999).

How does the online medium rate in terms of students and their learning? In examining the literature, the rhetoric varies. Learning through online media has been reported to provide several learning advantages, particularly for distance education students by providing them with the ability to discuss and share ideas – a collaborative learning process previously not available to this group of students (Eastmond, 1995; Harasim et al., 1995; Singletary & Anderson, 1995).

As an adjunct for face-to-face courses, it has been argued that online components in a course can alleviate the time pressures arising from students' work and family commitments which can affect their ability to attend classes (Franklin & Peat, 2000) by providing student-to-student and student-to-lecturer communication outside of normal classroom hours (Harasim et al., 1995). Despite enthusiastic reports of online advantages to learning, however, as Oliver (2001) points out, several studies have found no difference to learning outcomes whether or not online delivery is used as a supplement to face-to-face. These differences in the literature led us to ask the following questions. How much of the learning success and the perceived value of online delivery is determined by the level and types of responsibility taken by the students? What relationship does that responsibility have with the online experience provided by the lecturer? To address these questions, we decided to explore this idea of the value of supplementary online delivery through examining students' perceptions and output in comparison with the learning environment and intentions of the lecturer.

Methodology

As part of a larger study, this paper examines the perceptions and output of two 3rd year units where the online component was part of an integrated approach to teaching. This approach included face-to-face lectures, face-to-face tutorials/ laboratory time and online delivery. The units, focussing on systems and software development, were part of a managing information systems degree programme and were conducted by the same lecturer. The units had both similarities and differences in the use of the online components.

In both units, A and B, the students had a weekly two-hour lecture in which the major points of each topic were introduced and a variety of problems were discussed. In addition, the students were required to attend tutorials that which were conducted in a computer laboratory. There they answered tutorial questions and gained practical skills in systems and software development. Table 1 shows the points of assessment for unit A and their due dates, and Table 2 shows the same for unit B.

Assessment	Weighting	Due date
Tutorial tasks	10%	Task 1 – week 3 Task 2 – week 6 Task 3 – week 7 Task 4 – week 9 Task 5 – week 10
Assignment 1	15%	Week 5
Assignment 2	25%	Week 13
Final Exam	50%	

Table 1: Unit A Assessment points and weightings

Assessment	Weighting	Due date
Tutorial questions	10%	Tutorials 1 – 5 due week 6 Tutorials 6 – 10 due week 11
Assignment 1 (essay)	10%	Week 5
Assignment 2 (group proj)	30%	Week 12
Final Exam	50%	

Table 2: Unit B Assessment points and weightings

Several aspects of both units involved online components which that were made available to the students through WebCT. Available online were the course outline, the lecture overheads, the lecture guide, links to other sites, the tutorial activities, a sample exam paper, an email facility and a bulletin board. The differences between the units with regard to the online components lay in their use of the bulletin boards. In unit A, bulletin board discussion was not required as part of any of the assessments, though several fora were provided for student interaction and questions: a main forum, FAQs, sample exam discussion, tutorial discussion, lecture guide exercise discussion, and assignment discussion. The students were encouraged to use these to discuss any problems. Contributions were not compulsory and did not attract any marks. In unit B, similar fora were available for the same purpose. One forum, however, was a compulsory part of the first assignment and thus contributed to the final mark. As part of this assignment, the students were required to post one unique question in relation to the assignment topic and were to answer one other student's question.

Students' perceptions of the value and the use they made of the online components were ascertained through a written questionnaire (see appendix I). The questionnaire aimed to ascertain:

- which of the online components the students accessed;
- reasons for choosing to access (or not); and
- their perceptions of the usefulness of the bulletin board to their learning.

These perceptions were then related to and compared with:

- an examination of the online components, including the contributions to the bulletin board fora; and
- the lecturer's intentions.

The lecturer's intentions for the use of the online components in the teaching and learning process were ascertained through a semi-structured interview (see appendix II). The semi-structured interview aimed to determine how the lecturer integrated the modes of delivery, the reasons for doing so and the perceptions of the problems and impacts of the online component on students' learning.

Findings

Components Accessed

Out of a total of 90 students, 50 students (25 from each unit) responded to the questionnaire. Table 3 summarises the components that students reported as accessing.

Table 3 shows that most but not all students accessed the materials or tools on offer. Why did some students access certain components? Why did others not access them? What did some students find useful? What did others find to be unhelpful? The qualitative part of the questionnaire sheds some interesting light on these matters.

Components accessed/used online	**Unit A n = 25**	**Unit B n = 25**
Unit Outline	76%	84%
Tutorial Questions	88%	100%
Lecture Guide	84%	88%
Lecture Overheads	44%	96%
Links to other sites	80%	68%
Bulletin Boards	68%	80%

Table 3: Percentage of students who accessed online components

The Reasons for Accessing (or not) the Different Components

Students' reasons for choosing to access the various components are summarised in Table 4 and the reasons for not accessing are summarised in Table 5. With the bulletin boards being used differently in the two units, the reasons for and against accessing this particular component are reported separately for each unit. Note that not all students provided reasons.

Component	**Reasons for accessing components in both units.** The number of students expressing a particular reason is given in brackets.	
Course Outline & Assessment Details n = 40	Convenience (14) Could access out of uni (7) Up-to-date (3) To orientate to course (2) Could download (1)	
Tutorial Questions n = 46	Convenience (12) Could access out of uni (2) Save printing costs (2) Could get all the questions in one place (1) Could download (1)	
Lecture Guide n = 43	Convenience (8) Could access out of uni (2) Free printing in the library (1) Availability problems in bookshop (3) Could download (1)	
Lecture Overheads n = 35	Convenience (8) Makes following lectures easier (5) Revision/supplement notes (3) Could access out of uni (2) Only option (1) Free printing in library (1)	
Links to other sites n = 37	For further information (10) Download files/software (5) For assignments (5) To orientate to course content and expectations (2) Reduces search time (2)	
	Unit A reasons n = 17	**Unit B reasons** n = 20
Bulletin Board	For help with unit work (5) Just to read messages (4) FAQs helpful (4) Good forum (1)	Compulsory task (11) To read others' questions and answers (8) To ask about assignments (3) To discuss tutorial and lecture questions (1)

Table 4: Reasons given by students for accessing the various online components

Examination of Table 4 shows that most students accessed the components made available by the lecturer. Their reasons for doing so were mainly those of convenience of access to the resources. These students showed one of Merriam and Caffarella's (1999) characteristics of independent learning – they used the medium for locating suitable resources. For three of the components, some students also mentioned study and learning (as opposed to meeting course and assessment requirements) as reasons for their accessing. These included access to the lecture overheads, links to other sites and the bulletin board. For some, the overheads helped them follow and understand the face-to-face lecture. For others, they were useful for revision purposes. Some students specifically mentioned using the links page and the bulletin board to better understand the course content. These students' reasons showed that they were adopting learning strategies to help them to better understand – another characteristic listed by Merriam and Caffarella (1999) of independent, self-directed learners.

Component	**Reasons for NOT accessing components in both units.** The number of students expressing a particular reason is given in brackets.	
Course Outline n = 10	Had been handed out (4)	
Tutorial Questions n = 2	Had been handed out (2)	
Lecture Guide n = 4	Photocopied the guide (1) Bought a copy (1)	
Lecture Overheads n = 5	Lecture guide sufficient (3) Photocopied (1) Not available for this unit (1)	
Links to other sites n = 13	No time (1) Lecture guide sufficient (1) Conducted own research (1)	
	Unit A reasons n = 7	**Unit B reasons** n = 4
Bulletin Board	No marks attached (1) Not enough time (1) Prefer F2F (1) Not interested (1)	No need (2)

Table 5: Reasons given by students for not accessing the various online components

Examination of tableTable 5 reveals that when students did not access a given component, they were still showing self-directed learning behaviours. Most of these students found alternative ways of locating suitable materials, and some indicated that the resources did not necessarily support their learning requirements (for instance the lack of need for the overheads). Only a minority of these students appeared to take a superficial approach to learning such as occurred with one student relying solely on the study guide without undertaking further research. Interestingly, very few students avoided the bulletin board due to lack of assessment, citing other reasons for not accessing. These reasons can also be seen within a self-directed learning framework where students determined the best location for their learning (e.g. face-to-face); the strategies that best suited their learning (e.g. no need to use Bulletin Board, not of interest); and the best use of the time they had for study. Many students did, however, choose to use the bulletin boards. On using them, did they find the experience to be helpful?

Students' Perceptions of the Usefulness of the Bulletin Board to their Learning

Even though the bulletin boards were used differently in the two units, students felt that the amount they learnt from the experience was similar. In unit A, where the bulletin board was used voluntarily for self-help, 2 students (9%) felt that the bulletin board did not help them at all, 13 (62%) felt that it helped them "a bit" and 6 (28%) felt that it helped them "a lot". In unit B, where the one part of the bulletin board use was a compulsory part of an assignment and the rest voluntary, the students responded similarly: 2 (10%) felt that the bulletin board did not help them at all, 14 (70%) felt that it helped them "a bit" and 4 (20%) felt that it helped them "a lot". Table 6 shows the various reasons given by the students in each unit to explain their perceptions.

	Explanations given in Unit A (non-compulsory fora)	**Explanations given in unit B** (one compulsory forum, the rest non-compulsory)
How the bulletin board was helpful	Help from others (2) Similar problems (3) Others' questions (2) Keeps informed (1) Solutions to minor problems (1) Lecturer's contribution (3)	Interaction between students and lecturer (2) Others' questions (4) Discussing unsure questions (2)
How the bulletin board was unhelpful/frustrating	Lack of time to use tool (1) Not enough people using/ little discussion and information (4) Technical problems (6) Unanswered questions (2) Nothing of relevance (1)	Unanswered questions (2) Unhelpful answers (2) Doing research and practising exercises are more useful (2)

Table 6: Explanations given by students in each unit regarding the helpfulness of the bulletin board in their learning

Examination of Table 6 reveals that, even though bulletin board usage in unit B was compulsory and in the other it was not, the students from both units found that the bulletin board only helped their learning in minor ways with unanswered questions and pand poor quality of discussion/ answers being being a major frustration with this as a learning medium. This suggests the adoption of some learning behaviours, but not others. In the non-compulsory fora, many of the students were setting aside the time for learning and accessing the board, but they were not taking what Brandes and Ginnis (1986) describe as ownership of the learning and participating – essential student behaviours for learning with this tool. In the compulsory forum, however, when participation was mandatory, students' perceptions did not improve. In fact, a number of students felt that their learning and study time could have been better spent in other ways.

Lecturer's Intentions and Perceptions of the Impact of the Online Components

In interview, the lecturer revealed that he had two major aims in adding an online component to his face-to-face unit. These concerned the administration of resources and the desire to improve student understanding through increased interaction. Administratively, he wanted all the unit resources online so that students could access these as needed. He was in charge of large units and online access would save him time in dealing with students who asked him through the semester for various handouts and materials. In addition to putting the materials used in face-to-face delivery online, he also placed, in a portable document format (pdf), the external study and lecture guide which had previously only been sent out to external students in print form. This now allowed his internal students access to the detailed lecture notes and exercises that had previously only been available to external students. The students requested that the lecture PowerPoint slides also be made available and he complied. Based on the feedback he had received anecdotally and informally, he felt that the students liked the easy access to all the materials.

With his tutorials being run in a computer laboratory, his second aim for the online component was to increase interaction and thereby improve students' understanding and learning. He wanted a place for students to ask questions and sort out conceptual problems and to this end he provided the students with a variety of fora in the bulletin board. While he was disappointed overall with the amount of interaction that resulted, he did feel that the fora had improved depth of understanding, particularly where the contribution was assessed.

Examination of the Online Components

In both units, examination of the online components revealed an excellent resource base in easy to download formats. The tutorial questions were separated out and placed into one file for easy access. The links page targeted software and information that was directly relevant to their assessments. In addition, there was a full sample exam paper available for the students to work through. The resources certainly met the first aim expressed by the lecturer and, as he stated, putting these online in fact helped him to be better organised and prepared.

The bulletin board fora were designed to meet his second aim – that of increasing interaction to improve understanding. To examine whether this aim was met, the students' contributions were compiled on a forum by forum basis for each unit and these revealed a number of interesting patterns. In unit A, contributions were not compulsory but were made available for self-help. In a number of these fora, such as the forum for the questions in the lecture guide and the forum for the tutorial exercises, students did not make any contributions at all. These resulted in contributions only from the lecturer who posted notices or tips appropriate to that forum. The remaining fora had questions from the students, but these were directed to and answered by the lecturer. These included questions on unit requirements, technical problems and questions about the assessments. None of the students answered any of the posted questions. This contribution by the lecturer was the reason that the students found these boards helpful without needing to participate more fully.

In unit B, most of the non-compulsory fora were used in the same way as occurred in unit A. In one non-compulsory forum, where the lecturer stated explicitly that he would not answer questions (these were to be answered by students only), questions were posted but none were answered. It would appear that the students were not prepared to take the responsibility expected by the lecturer in this type of forum. In the compulsory forum, questions were both posed and answered by students showing that marks certainly increased participation.

Discussion

These findings show that the students adopted roles in which they took certain responsibilities but not others in their online learning. Why did this occur? One way of reflecting on these findings is through reference to teacher-centred versus student-centred models of learning. In teacher-centred approaches, information is handed out to students for learning and later assessment (Brandes & Ginnis, 1986). When students have questions, they direct these to the teacher. It is expected that the teacher as expert is the appropriate person to ask, and hence answer, the question. Other students are not necessarily viewed as a resource for developing learning.

Despite claims that online learning is by its nature "student centred" (Berge & Collins, 1995), this study shows that supplementary online delivery can mimic the roles adopted in traditional classrooms. As in traditional delivery, materials were made available to students in a number of modes, and students met their responsibility of gaining those materials, sometimes through the online medium and sometimes not. They also adopted strategies to suit their learning such as using the overheads to help follow the lecture. In their preparation for assignments and examinations, when the students had questions, they used whichever means they had available to ask the lecturer – bulletin board, email or face-to-face contact. The participants demonstrated self-directed learning and met their roles and obligations as required under a teacher-centred model.

In this traditional view of teaching and learning, it would appear that the students did not see it as their role, or perhaps to their advantage, to answer other students' questions in the non-compulsory fora. Much as occurs in the traditional classroom, some students asked questions while others watched and took note of the teacher's answers. A greater level of participation on their part was not necessary. From this teacher-centred view, the students were overall satisfied with the supplementary provision. It provided additional flexibility in gaining information that otherwise would only have been available through face-to-face and paper modes. As this flexibility simply provided the same information, it is not surprising that the students felt that it did not impact greatly on their learning. In a teacher-centred use of online supplementation, the value lies in its flexibility not its contribution to increased learning.

In student-centred approaches, there is a shift of emphasis away from the teacher to participation, discussion and discovery amongst the students (Brandes & Ginnis, 1986) and this is considered desirable in the online environment (Harasim et al., 1995) as a means of improving learning. It would appear from this study, however, that despite the best intentions of the lecturer and the provision of appropriate online tools for discussion and interaction to occur, collaborative learning did not occur in the non-compulsory fora and occurred in only a token sense in the compulsory forum. Even though participation clearly increased in the compulsory forum, students still only reported limited learning, suggesting that they took limited ownership of their learning, going through the motions to satisfy assessment requirements.

Why did students not adopt the collaborative learning role required in a student-centred approach? In examining the unit and the online components it would appear that the conditions outlined by (Brandes & Ginnis, 1986) for student-centred learning may not have been met. In order for students to adopt the roles required of them in a self-directed, student-centred environment, the lecturer needs to provide an educational context that allows desired student behaviours to flourish. In this study, the lecturer provided a tool for discussion to allow students to become involved in their learning. However, without the added aspect of a task that has significant relevance and meaning for the learners and which requires collaboration (such as a need to solve a problem), engagement with the material in discussion remained superficial and hence additional learning was minimal. To add to this, student-centred types of behaviour were not required in the face-to-face context. It would appear that students did not reconceive their roles in a different light when shifting from the more teacher-centred approaches of the face-to-face classroom to the more student-centred expectations of the online discussion forum.

Conclusion

This study shows that the roles and responsibilities adopted by students affect the value that online supplementation can bring to face-to-face delivery. Student roles and responsibilities do not, however, arise in isolation. They emerge out of the educational context provided by the lecturer. Online provision is not on its own "student-centred". Rather, it is a medium for the delivery of a course which can be structured by the lecturer to be more student-centred or more teacher-centred.

For tertiary courses that are either teacher or student-centred, this study shows that online supplementation does provide added flexibility. The students are self-directed and do take the time to obtain the resources, either through the online medium or through other media, and they use these resources to support their own strategies for learning independently. This flexibility is valued by the students.

However, adding value to learning through online supplementation is more difficult to achieve as has been noted by other studies (Oliver, 2001). The online provision has to offer more than is already offered in the face-to-face context. One way that has been suggested is through the more thoughtful and considered discussion that a bulletin board can provide (Harasim et al., 1995). This study shows, however, that to achieve this, the learning environment needs to provide the students with a real and meaningful reason for collaborating or discussing an issue in depth. While the allocation of marks does increase participation, this study shows that participation on its own does not necessarily improve the learning. Online provision needs to be carefully structured if student-centred behaviours are to emerge.

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Appendix I

Student Questionnaire: Use of materials placed online

Do you access the following materials online ?

- Course Outline Yes No
  Please explain why/why not
- Tutorial Questions Yes No
  Please explain why / why not :
- Lecture Guide Yes No
  Please explain why / why not
- Lecture Overheads Yes No
  Please explain why / why not
- Links to other sites Yes No
  Please explain why / why not :

Use of bulletin board

Did you use the bulletin board? Yes No
Please explain why / why not :
If yes,
Did you find that bulletin board helped your learning?
Not at all A Bit A lot
Please explain :
What did you find helpful in using the bulletin board
What did you find unhelpful/frustrating about using the bulletin board?

Appendix II

Semi structured interview schedule for lecturer

1. What is the online component of your course? What other resources do your students have ?
2. What do you want your students to get from the online component?
3. Is there an assessment component for online work?
4. What feedback have you had from students?
5. What do you feel has been the value of online?
6. Has it impacted on the depth of learning?
7. Have you any problems with online?

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INTERFACES FOR E-LEARNING: COGNITIVE STYLES AND SOFTWARE AGENTS FOR WEB-BASED LEARNING SUPPORT

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Abstract

The amount, range and quality of information available to students and other academic users have increased enormously in recent years. Consequently, it is possible for individuals to either suffer from information overload or to get lost in cyberspace while trying to locate relevant information. This paper looks at the relevance of cognitive styles and software agents to human computer interaction and interface design. Each student has a cognitive profile which can help the individual develop his or her learning skills and strategies in the light of useful self knowledge. The combination of prior knowledge of an individual's cognitive style with the technical solutions offered by adaptive and intelligent interfaces suggest a possible way forward with respect to the problems of information overload experienced when using the Web. The application of a particular view of cognitive styles to information handling and interface design is considered. Adaptive interfaces and Internet agents are looked at in relation to moving towards more individual designs for interacting with the Net and Web.

Keywords

e-learning, cognitive styles, software agents, adaptive interfaces

Introduction

This paper looks at the problem of effective student access to information resources from networks. More specifically it looks at the relevance of cognitive styles, adaptive interfaces and software agents to accessing information from the Internet and the World Wide Web. This will be done by attempting to identify and define the attributes of a type of interface that would help assist users in efficiently handling the increasingly large amounts of information available to them via networks. For the purpose of this paper, three main themes will be explored: adapting the interface to the user, using personalised information retrieval agents and identifying and using individuals' cognitive styles to develop an information retrieval strategy implemented via the interface. The relationship of these elements to the problem of accessing relevant information from the Internet and World Wide Web will be considered. This will be done by attempting to identify and define the attributes of a type of interface that would help assist users in efficiently handling the increasingly large amounts of information available to them via networks.

Cognitive Styles and Learning Styles

The relevance of an individual's cognitive style and learning style to that person's performance in a range of learning situations has been explored by many authors over the years (Kolb, 1985; Honey & Mumford, 1992; Riding, 1991, 1997; Laurillard, 1979, 1993; Ford 2000). Although the terms have been used interchangeably (Sadler-Smith, 1996; Riding, 1996), learning styles can be considered to cover a much broader range of approaches to learning. They often consider factors that can vary for the individual, e.g. an individual's learning style could differ according to the subject s/he is studying, the mode of assessment employed or even the amount of time available. The possibility of variance over time and learning situation can call into question the relevance of attempts to use *individual* learning styles to inform the development of computer-based learning materials (Valley, 1997). It is considered that cognitive styles are more fundamental to the individual's personal and psychological makeup. Sadler-Smith (1996) considers learning styles and cognitive styles to be "fundamentally quite distinct and having differing but complementary implications for the design of teaching".

A recent volume draws together the various strands and provides a comprehensive overview of the work on cognitive styles (Riding & Rayner, 1998). An excellent review of the field and its evolution is also provided by Rayner and Riding (1997). Further work relates cognitive styles to developments in the Internet (Riding & Rayner, 1995) and technology-based training (Riding, 1996). Riding often uses Tennant's (1988) definition of cognitive style as "an individual's characteristic and consistent approach to organising and processing information" (Riding, 1995; 1991). From this perspective, cognitive style is considered to be a central and unchanging part of the individual's personal and psychological makeup or "a fixed characteristic of an individual" (Riding, 1996). It should be noted that cognitive style differs from learning style that can be considered to vary over time and space (Valley, 1997). Sadler-Smith considers learning styles and cognitive styles to be "fundamentally quite distinct and having differing but complementary implications for the design of teaching" (Sadler-Smith, 1996). If cognitive styles are individual and non-changing then they could provide a important element for designing more individualised interfaces and helping the individual deal with information overload.

Cognitive Styles and Information Overload

The amount, range and quality of information available to students and other academic users have increased enormously in recent times. This information can be regarded as a resource of great educational significance. However, it can be suggested that it is not a true resource until users possess the required skills, knowledge and suitable interface to maximise its utility (Palmquist & Kim, 2000). Although access to the WWW and its data sources has become easier via tools like Google, Quickclick, Atomica and Ask Jeeves, their use can be a double-edged sword. They identify and facilitate access to numerous data sources but also increase access to vast amounts of relatively unstructured information. As one observer commented: "Knowing that all of the information is out there, but not knowing exactly how to find it, can make the Web browsing experience quite frustrating" (Bigus & Bigus, 1998).

The ability of large amounts of information to "overwhelm and disable rather than liberate and enable" was pointed out rather earlier (Fitzgerald, 1994).

This scenario has particular relevance for those studying in higher education. The move towards active learning means that students will increasingly need to search for and download information from networked sources. In response to the problem of potential information overload, an increasing number of software agents have been made available to help the user in the search for the right information (Maes, 1994; Cheong, 1996). The particular type of software systems considered here are interface agents and Internet agents (Nwana, 1996). Adaptive interfaces can also be considered to be one type of interface agent.

Student information requirements vary. In addition, the knowledge and behaviour of students with respect to the learning process can change both over time and at the same time (Riding, 1995). Given this scenario, it is possible to suggest a need to develop interfaces that help each student to reflect on, identify and develop:

- her/his broad information needs;
- the clarification of those needs in a way that helps specify key information attributes; and
- the attributes to help reduce the search space and increase the precision of the information retrieval process.

The identification and use of cognitive styles and learning strategies combined with adaptive and intelligent interfaces can help facilitate the achievement of these goals. It is suggested that providing interfaces, which can both adjust according to the different needs of different users and send out agents to identify and retrieve relevant and useful information, can help do this.

Cognitive Styles and Interface Design

Over a period of twenty years and in many studies, questions that relate to the problems of interface design for learning materials have been consistently asked. These include:

- How does the structure of the material to be learned interact with style?
- Does the mode of presentation of the material affect learning?
- What effect does the type of content have on style and learning? (Riding & Rayner, 1998)

In terms of the physical organisation and external appearance of the learning material, studies by Douglas and Riding (1993), and Riding and Sadler-Smith (1992) related learning performance to material organisation and viewing (and hence possible interface design) to factors such as the size of the viewing window, the inclusion of headings and overviews of material and the step size of learning material, i.e. the physical layout.

Other studies (Riding & Ashmore, 1980; Riding & Douglas, 1993; Riding & Mathias, 1991) found that the mode of presentation as represented by verbal, pictorial or auditory modes affected learning performance according to cognitive style. Riding & Rayner (1998) commented that:

> In terms of content type, individuals appear to learn best when information can be readily translated into their preferred verbal-imagery mode of representation. It is of interest to note that not only the mode of presentation, but also the content itself, affects learning performance to an extent that it is of practical significance.

Dimensions of Cognitive Style

In an extensive overview of the work on learning and cognitive styles over the past 30 years, Riding and Rayner (1998) attempted to classify and integrate much of the earlier work in this field. They argued that many of the different labels used to categorise cognitive styles and learning styles were "different conceptions of the same dimension". A range of classifications were compared and contrasted with each other. Two principle cognitive style dimensions were identified.

- **Verbal-Imagery** - an individual's position on this dimension determines whether that person tends to use images or verbal representation to represent information when thinking.
- **Wholist-Analytic** - an individual's position on this dimension determines whether that person processes information in parts or as a whole. (Riding and Rayner, 1998)

The two styles are seen as independent and Riding has developed a software package, the Cognitive Styles Analysis (Riding, 1991) that allows the user to quickly and easily measure the cognitive style of individuals on both dimensions.

Measuring Cognitive Style and Implications for Interface Design

The Cognitive Styles Analysis test is easy to administer taking only about 10-15 minutes for each individual to complete. The verbal-imagery dimension is tested using pairs of words which are compared according to colour or category. The wholist-analytic dimension is tested by presenting the user with two similar images at once. The user has to determine whether the images are the same or if the first is included in the second. Over the past decade, Riding and others have extensively investigated the cognitive style construct using the Cognitive Styles Analysis test (Riding & Read, 1996; Russell, 1997; Pillay, 1998). The tests have been done on a variety of age groups and in different settings and have consistently suggested that the cognitive style of an individual can affect learning related elements such as:

- preferred format of instructional material (Pillay, 1998);
- learning in a vocational training environment (Russell, 1997);

- preferred mode of working (Riding & Read, 1996); and
- the effectiveness of book or hypertext (Wilkinson, Crerar & Falchikov, 1997).

It is therefore suggested that individuals with different cognitive styles could benefit from interfaces which could be adapted to the individual's style. This would modify the interaction between the user, the computer system and the communications network according to the cognitive style of the user and related information requirements. The result would be to improve the user's ability to assimilate the information being accessed.

Software Agents and Intelligent Agents

The term "intelligent agent" refers to a form of human computer interaction which uses software agents which have some component of "intelligence" built into them (Wooldridge & Jennings, 1998). The similarity between intelligent help systems, adaptive systems (considered a form of the application of interface agents) and explanation systems is explored by Benyon and Murray (1993). Although it is recognised that there are also differences, it is suggested that these systems share the same high level architecture with the overall architecture containing three different models - the user model, the domain model and the interaction model. The user model, which is the most complex of the three, contains cognitive, profile and student models of the user.

Interface and Internet Agents

At the Media Lab at MIT, a wide range of projects is underway which consider different roles and types of software agents (Maes, 2001). Maes considers the range of applications agents can assist with as being very broad indeed. Possible application areas include the scheduling of meetings, help in selecting films, music and books, information filtering for email and the information retrieval possibilities considered here (Maes, 1994).

Agents can be thought of as software assistants which perform tasks for the user (Keeble & Macreadie, 2000; Maes 1994). Following this, intelligent agents can be seen as agents with an AI component (e.g. an expert or knowledge-based module or system) embedded within a conventional system. The intelligent agent is then able to provide support and advice for the main system, though the range and potential of the intelligent agent field is much broader than this.

Interface and Internet/ information agents are two of the main categories of agent type that usually emerge from different classification schemes (Nwana, 1996, Wooldridge & Jennings, 1995). Maes considers that the main area of concern is the development of interfaces that "make human-computer interaction easier and more effective" (Maes, 1994), and also considers the types of solutions that may be offered by the AI community, including learning interfaces and interface agents. When looking at the potential of software agents to help reduce information overload, the same author develops the argument that different types of agents can help users in several ways. It is possible to develop agents which can monitor events, do things on behalf of the user, collaborate with other users and so on. In doing so they often conceal the fact that the task may be complex and difficult.

Discussion: Interfaces for Learning Support

The process of learning is a multidimensional, multi-process activity. One important aspect is the identification, location, organisation and use of information and its transformation into knowledge. As stated, an increasingly significant source for this information is the WWW. As its importance grows, so does the need and ability to perform the identification, location, organisation and use process. The WWW, browsers and search engines provide unrefined tools, very useful but prone to lead to information overload. They are also increasingly time-consuming, especially when communications traffic is busy. To help solve this problem, many agent-based information retrieval systems are currently being developed. Early applications started as systems to enhance the user's ability to make sense of the web, but now the functions are becoming more focused. These include applications like Aberdeen University's ELVIS (Enhanced Learning Visitor Information Systems) which provides a personalised brochure of travel information on a town or cities shopping, restaurant, cultural and entertainment facilities (Edwards *et al.*, 1997). The user enters the details for a particular destination and leaves the system. The information is delivered later in the form of a brochure after the agent has completed searching the Web. A development of ELVIS is the same institution's MAVA (Multi-Agent Visitor Advising) that takes the assistant analogy further by attempting to "reason about the likely success of a user query, and if necessary, adapt the query" (Edwards *et al.*, 1997).

Interfaces and Agents to Support Learning

One of the main areas of commercial interest in the application of agent-based technology is the provision of "personal assistants" (Maes, 2001; Nwana, 1996). If the same approach is considered for helping to support student learning then it is possible to state a case for the integration of the elements covered in sections 2 to 4. The adaptive interface or interface agent can help tailor the information presented to the specific and individual needs of the user. The software agents (autonomous and decision making) can be initially configured to perform particular tasks for the student, based on the cognitive style and learning needed for the tasks in hand. The cognitive styles analysis should be used in conjunction with the student and domain models developed for the adaptive interface. These models could then be integrated to provide a sophisticated mode of individualised interaction with the Internet and the World Wide Web. What is needed is a system which both helps the student to interact with the Web to obtain information and then organise and use that information. The system that might emerge could be something along the lines of an Interactive Learning Environment (Arshad, Kelleher & Ward, 1995).

For the student involved in the new learning environments of the contemporary university, a similar metaphor can be applied to the process of supporting student learning or helping active learning. That metaphor would be of a learning assistant, or perhaps an information assistant in this case. The aim would be related to that of Maes' personal assistant (Maes, 1994). The role of the agents would be to help individual students to function effectively with different and more student-centred resources. A fully developed Student Information Manager (SIM), taking some of the functions from Maes' personal assistant could perform the following services:

- electronic mail filtering;
- class and meeting scheduling;
- assignment information searching;
- appropriate information presentation;
- book and article recommendation; and
- management of information student resources, including indexing, cross-referencing and updating for consistency.

Several systems are currently being developed which include some of these elements. A measure of the effectiveness of using software agents for online learning has been described by Thaiupathump, Bourne and Campbell (1999). The authors use the term knowbots (knowledge robots) to describe this type of agent and their purpose is to help automate aspects of online workshops in order to help the facilitator. In addition, the authors looked at the impact of the knowbots on learner satisfaction and facilitation time. Elsewhere, a different perspective from that of cognitive styles is taken when considering the cognitive aspects of agent based learning environments (Baylor, 2001). Using MIMIC (Multiple Intelligent Mentors Instructing Collaboratively), the author considers issues of control in such environments. One version of MIMIC contains two software agents, an Instructivist Agent and a Constructivist Agent, which are designed to facilitate the mentoring of pre-service teachers. Chatterbots are another class of agents that are being adapted use in learning situations (Knode & Knode, 2000). The agents are configured to act as intelligent tutors. The aim is to provide agents which "provide content appropriate for individual lessons and can perform other tasks automatically, such as opening web pages, reading text, running other programs, answering questions and providing instructions". Several of the agents used in this study are available from the Botknowledge website.

The above functions are likely be both appropriate and necessary if students, as seems likely, become more involved in active learning. By definition, each student will develop her or his own self-constructed database of learning materials. We may all be in danger of drowning in a sea of information and if students are not to become lost in unstructured information 'lakes' of their own construction then the development of the above type of aids will become of paramount importance. For the moment, we will remain with the concerns of the interface design related to cognitive style.

Initial Empirical Work

Initial work has taken place with 70 students undertaking a Human Computer Interaction unit. The students worked mainly on the cognitive profile and interface development aspects suggested above. A range of qualitative and quantitative measures were used to get the students to engage with the design process and reflect on the role of their own cognitive styles in that process. These included the Cognitive Styles Analysis test, log files of each student's interaction with a set of interfaces design in different styles, reflective journals and both the documentation of plus the actual interfaces produced. The results of this work are currently being analysed with reference to moving on to the agent-based aspects of the learning environment design. These findings will be discussed more fully at the conference.

Conclusions

It would appear that the cognitive style of each individual has an important impact on how each person internally represents and processes information. Cognitive style then, could be an important factor in the design of more effective individual interfaces. The development of agent-supported interfaces and learning environments would further help support the student in the demanding activities of online and e-learning. Problems continue to exist with the overall development cycle (Hook, 2000), but continued work in this area will help overcome them.

The current political, organisational and social changes occurring in higher education provide serious challenges for allocating resources to reorganising student learning. Many institutions are combining the need for change driven by decreasing resources with the potential offered by information technology developments to support student learning. This produces additional problems in the form of easy access to enormous amounts of relatively unstructured data and information. It is suggested that modelling and combining knowledge of an individual's cognitive style and integrating that with adaptive interface design and the use of Internet agents provides a possible solution to some of these problems. This paper has looked at the relevance of cognitive styles, adaptive interfaces and software agents to interface design and human computer interaction with reference to accessing information from the World Wide Web. An attempt was made to draw together the above themes to provide an approach to using cognitive styles and software agents to help inform the development of suitable individual interfaces and learning environments. This could be a significant factor in the production of environments that would help students to learn more effectively by locating and processing information from the Web and other networks in a more efficient manner.

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A CRITIQUE OF EDUCATIONAL TECHNOLOGY RESEARCH IN NEW ZEALAND SINCE 1996

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Abstract

In this paper the authors examine a broad range of literature relating to research into educational technology in New Zealand published since 1996. The literature ranged from conference presentations to journal articles, both printed and online, and from collaborative international research to the reporting of teaching experience. We saw positive signs in terms of the quantity of research being produced in New Zealand; however, the critical questions for our study related to the quality of that work. The study looks at the relationship between the researcher's choice of methodology and their pedagogical framework, concluding that, whilst much of the literature in this field is comparatively light methodologically, this can be justified by a constructivist approach to teaching and learning. New Zealand research appears to be maturing but questions must be asked about a climate that encourages research purely for the sake of the research output and where funding is limited. Perhaps because of the lack of funding opportunities, we are grounded in praxis, more interested in looking at what we do than exploring the theoretical possibilities that technology could offer. Although we tend to ignore the lessons of history, our findings show that government policy is a concern for a number of researchers. This is primarily in terms of the policy makers not being able keep pace with the rapid changes that we have seen but important issues such as funding and training for staff are also discussed.

Keywords
educational technology, instructional design, New Zealand, research methods, pedagogy

Introduction

In this paper the authors will examine a broad range of literature relating to research into educational technology in New Zealand with the aim of determining the quality and maturity of this sector of academic research. Specifically, that is research related to the use of Information and Communications Technology (ICT) in an educational setting that has been conducted in New Zealand, by a New Zealand-based researcher or to which a New Zealand-based researcher has made a significant contribution. In preparing this report, the authors selected literature from a range of sources, including the Internet, databases, conference proceedings and journals. As Hodges (2001, p. 3) recommended, we have organised our literature into "discreet categories", noting, however, that there is overlap. We reviewed each paper, looking for key phrases or definitions as well as for references to earlier studies and literature that supported the philosophical stance of the researcher.

We reviewed 46 papers, all published after 1996. Of these, 37 originate from refereed journals or conference proceedings and the remainder from academic websites or Government departments. Nineteen of the papers were published or presented overseas (ten in Australia), with the remainder published in New Zealand. In particular, we drew material from the conferences of the Australasian Society for Computers in Learning in Tertiary Education (ASCILITE) and from the National Advisory Committee for Computing Qualifications (NACCQ). We will critique the research in terms of its method and methodology and then categorise and discuss the research in the context of its pedagogical framework, educational level, historical place, the development of educational policy and what technologies are being used. We will then draw together the findings of our research by way of a conclusion.

Research Methods

Research can be described as an investigation that will examine, develop or contribute to existing knowledge. Cresswell (1998) refers to the process of research as starting with the selection of a research paradigm and a format for pursuing the methodology within the chosen paradigm. In this section we will identify and observe the research paradigms and methodologies used in the literature. Figure 1 shows a trend towards qualitative research, either in a pure sense or when a triangulation of quantitative and qualitative methods is used (Cresswell, 1998).

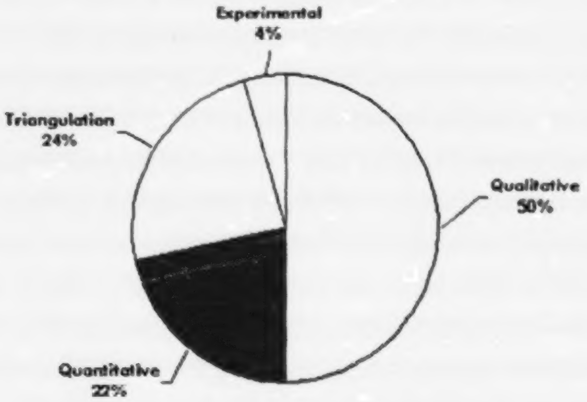

Figure 1: Breakdown of research methods

We observed that quantitative researchers tended to be more definite about their research methods and the majority of researchers only briefly touched on the methods and methodologies used. Methods included case studies, focus groups, observations, questionnaires, surveys, documentation analysis, interviews, discussion groups and personal reflections on praxis. Methodologies, where defined, included grounded theory, ethnography and experiential approaches. This section presents a critical analysis of articles and journal papers from the perspective of the method and methodology.

Questionnaires and surveys were prominent, used by both qualitative and quantitative researchers. Patek, Kinshuk and Russell (2000) took a quantitative approach to describe how learning resources are categorised to match them to different phases of skills acquisition. Goodwill (2000) used questionnaires and surveys when collecting data to analyse students' perceptions. Although this data was used to formulate strategies to improve course delivery, a qualitative approach, the results of the questionnaire were used quantitatively to analyse documentation such as enrolment data and

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pass rates. Document analysis, such as test results, enrolment details and data collection from questionnaires and surveys were the commonly used methods. Kwok-Wing (2000) presented a quantitative review of computer usage, ergonomic factors and awareness when conducting a study into the extent of awareness of health risks associated with computer use in schools. Kwok-Wing touched on the reasons for the reticence of many teachers to embrace ICT in the classroom but purely as an aside and this was not integral to the main study.

Bhandari (2000) used a case study to observe the use of computers in a classroom setting for tertiary level classes. For Ryba, Selby and Kruger (2000), case studies and participant observation were used to study how ICT can be instrumental in creating socially interactive and reflective learning communities. Being focused on creating viable online communities of professional practice, the writers are not immersed in their study at a participatory level, remaining as aloof observers. Experiential qualitative research was minimally evident. Gerbic (2000) described a post-graduate course taught online at AUT and how this course used asynchronous conferencing, learning activities, assessment and journal spaces for students. Mason (1996) took an experiential perspective to her ethnographic research into an article written on classroom practice in primary schools. The author is immersed in the focus of her research, more than just observing student behaviour in teaching and learning situations, Mason reflects the way she interacted with her students and interprets their responses to her. Many of those using focus groups, interviews or discussion groups did so after gathering the outcomes from questionnaires and surveys. Using a triangulated approach, Selby, Young and Fisher (1997) combined questionnaires and interviews to identify conditions that contribute towards the low number of women in tertiary computing courses. Other cases of triangulation of quantitative and qualitative methods using comparative analysis were observed.

The research focus was reasonably well explained and conclusions generally thorough, more so where the research was quantitative. However, qualitative research on many occasions lacked the methodological assumption, failing to clearly describe the process of research as it related to the focus of the study. As reviewers, we were often left wondering about the format of the overall design of the research, forced to analyse the researcher's approach to the study and often left to read between the lines. It was wondered if this is a phenomena particular to educational technology and related to the researcher's pedagogical framework, the relative newness of this field or the diverse backgrounds of the researchers: Certainly a review of research practices in nursing literature (Benton & Cormack, 2000) indicated an expectation of particular structures and always a clear methodological framework that is missing from much of the literature reviewed here.

As we have observed, there appears to be some correlation between research paradigm and pedagogy and so we will now discuss the pedagogical framework for the literature under review.

Pedagogical Framework

Although the authors have embraced the constructivist viewpoint, we found it appropriate to classify the literature with regard to the educational philosophy, be it instructivist or constructivist, when analysing studies of a pedagogical nature. Instructivist and constructivist pedagogies are at two ends of a continuum of teaching and learning theories. Instructivist pedagogies are based on transmission of knowledge which is teacher-directed, systematic and structured, whereas the constructivist viewpoint sees knowledge as constructed, participatory and meaningful, where the learner directs their own learning in order generate their own knowledge (Roblyer & Edwards, 2000). Instructivist and constructivist pedagogies have their parallels in the quantitative and qualitative research paradigms. Approaching the research through a pedagogical lens allows us to explain the tendency of the qualitative researcher to be less method-specific, in that the constructivist worldview sees knowledge as constructed by the learner, raising awareness rather than answering specific questions (Roblyer & Edwards, 2000). It also important to understand the different components of a computer-based cognitive tool (CBCT) and Kennedy and McNaught (2000) promoted the following categories: software tools, content and educational environment. A distinction can also be drawn between tools that facilitate the delivery of the content rather than being teaching tools in themselves.

The Educational Review Office (ERO) provides a context for educational technology and its impact on pedagogical issues in its 1997 report (Education Review Office, 1997). In a quantitative study, Patek, Kinshuk and Russell (2000) evaluated student's preferences for using computer-based intelligent tutoring tools that provided students with an instructivist environment for learning. They commented that the computer-based approach was effective in the acquisition of different phases of skills in a cognitive apprentice-based learning environment.

Scott and Skerman (2000) promoted a constructivist approach to assist teachers to create learning environments where meaningful learning can occur. Different models for teaching technical subjects to tertiary students were discussed by Burrell (2000) and Laxer (2000), the former reflecting on personal experiences of teaching object-oriented programming and the latter, examining perceptions that computing students often lack mathematical skills, postulated that this was a barrier to learning in technical disciplines. Similarly constructivist in approach, Fletcher (2000) used case studies to highlight factors of website design that engage students in purposeful and interactive learning on a science website. A study looking at the relationship between the introduction of multimedia into a learning environment and the impact this has on teaching (Hill, 2000) presented a variety of learning theories, classroom management and teaching techniques that were relayed from the experiences of classroom teachers.

The majority of literature addressing pedagogical issues focused on the Internet as an educational tool, although often without stating whether this is focused on computer-based cognitive tools as opposed to the computer-facilitated delivery of content. Online and distance education as well as synchronous and asynchronous communication are prominent topics. Johnston (1998) identified changes to pedagogy required in this new environment, contrasting these with the traditional role of the teacher.

Using multimedia for creating engaging learning opportunities also features in the literature. Multimedia learning environments for students with special needs are the subject of a study by Roder (1998), and Koh and Thurston (1998) explored the use of multimedia in teaching fractions, albeit through advocating the use of "drill and practice" testing and retaining an instructivist paradigm. Koh and Thurston discussed learning theory as it relates to the delivery of courses using multimedia and reflected on experiences with special needs students. The personal experience of the learner and the process of learning being factors that greatly contributed to success.

Educational Level

Figure 2 indicates the research paradigms used with respect to the different educational levels, showing that there is an emphasis on research in the tertiary sector. The literature itself shows that a significant factor in this is "show and tell" research, where practitioners are describing their own teaching process.

Research Paradigm	Primary	Secondary	Primary and Secondary	Tertiary	Adult/ Lifelong	Non-specific	Total
Qualitative	3	1	2	9	2	6	23
Quantitative	1	1	3	3	1	1	10
Triangulated		2	1	6	2		11
Experimental				1		1	2
Total	**4**	**4**	**6**	**19**	**5**	**9**	**46**

Figure 2: Research paradigm by level

Technology

The literature primarily focused on strategies and methodologies for exploring, developing and implementing traditional and ICT-based learning tools. Figure 3 indicates two primary areas of research, the application of technology as a learning tool in the traditional classroom environment and the use of online technology to extend the teaching and learning environment.

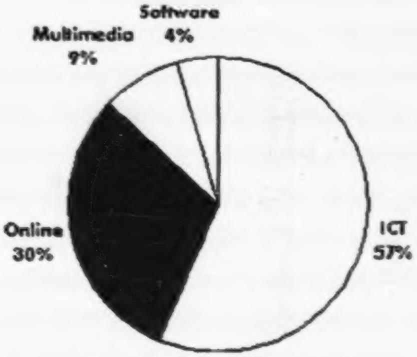

Figure 3: Technology breakdown

The research shows that technology empowers teachers and students to explore learning concepts through the use of real world data and simulations of real world events, it is not itself the focus of learning. Educators trained in the uses of technology must know how to integrate it into their curricula and must integrate ICT in its broadest, all encompassing sense. Assessing technology's impact on learning is a priority and the research indicates that schools and tertiary institutes are grappling with the problem of developing accurate instruments to measure the benefits and drawbacks of educational technology. In this context, we will now look at the literature with regard to the development of policy around the application and development of educational technology.

Policy Development

Government drives education policy, yet Roberts and Peters (1998) argued that successive governments have kept policies regarding educational technology at arms length. They argued that current policy has failed to keep pace with the rapid changes in technology. Jones (1998) concurs, observing that New Zealand has failed to differentiate between the design and the delivery of technology-related areas at a policy level. Countering this, a study by Higham, Sharp and Priestley (2000) concluded that New Zealand has developed an educational policy with a focus on ICT integration, resulting in significant investment in ICT.

Supporting the development of ICT policies is the need to critically analyse how technology is being implemented in schools. Jones and Moreland (online) suggested further research to understand the impact of technology on assessment practices in primary schools. ERO (2000) examined how effectively schools are implementing ICT and whether ICT is used effectively to support teaching and learning. This study focused on the technical aspects of ICT, although it did discuss ethnicity, socio-economic factors and the technical and pedagogical of teaching staff. This report is the definitive observation on the current state of ICT in teaching in New Zealand schools, dealing with issues such as funding, policies and procedures. At tertiary level, new educational technologies are identified as impacting on the way teaching occurs (Gunn, 2000) and on staff development (Gunn *et al.*, 1999).

Ryan (1999) stated that technology is not of itself value-free, suggesting that the modern curriculum include consideration of the ethical dimensions of technology. However, teacher education is required since current knowledge is a limiting factor. Jones (1998) supported this need for better policy integration and Hunt (2000) raised the additional issue of increased integration of ICT within courses, documenting the experiences of student teachers in managing the increasing amount of technology in the classroom. These findings are supported both by ERO (2000) and in a comparison study of New Zealand and English schools (Higham, Sharp & Priestley, 2000). Gunn

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(1998) observed that the use of ICT by academic staff is limited by factors that include interest, competence, availability and resources. This research identified adequate financing, support and training as barriers to the uptake and effectiveness of educational technology at tertiary level.

Just as Hunt (2000) and Gunn (1998) discussed how educational technology impacted on teachers, technology also impacts on students. At tertiary level, students are impacted by the real world that they are about to enter, raising issues about how technology students are themselves taught. Both Fielden (1998) and Goodwill (2000) observed that understanding technology is not enough, there must also be an understanding of the context and that, to succeed in today's workforce, students require a broad range of skills. Extending this concept of the appropriateness and context of technology, Brown (2000) discussed how the delivery of education must change to encompass not only the Internet but also the concept of a society as knowledge-based, where learning is lifelong, tailored to need and culturally appropriate. Brown observed that this shift in the delivery of education is difficult to achieve without sound policies for addressing and managing it.

Historical Perspective

Much of the research described so far has been anchored in praxis and looked forward to recommend strategies for educational technology. In this section we will discuss how the literature approached educational technology from an historical perspective, identifying elements that draw on historical information. Few of the papers dealt with the historical perspective; only five papers are referred to in this section with a tendency amongst researchers to focus on current practice and to project this forward into recommending ways of improving teaching and learning.

The effectiveness of ICT in schools from an historical perspective is described by ERO (1997; 2000). The 1997 report situated ICT in the current educational context and the 2000 report discussed the evolving usage and uptake in ICT in the context of the socio-economic and political climates. Other researchers also situated ICT in a social context and looked at the historical development of ICT in New Zealand. Gunn (2000) discussed how rapid changes in educational technology have created challenges in the tertiary sector. The author reviewed historical developments and identified the motivations that drive educational technology. Earlier, Gunn (1998) reviewed how academic staff used ICT and identified factors limiting this usage.

Conclusion

In reviewing the 46 papers, we have seen a wide scope of research being undertaken and New Zealand research being presented in a variety of national and international contexts. There is no question about the quantity of work being produced; the question we posed in the introduction was related to the quality of the work. Our results can best be described as a "mixed bag"; we reviewed papers that are well grounded, applying research and praxis to a situation and then building on these findings to improve educational technology. We have also reviewed research that is light, poorly grounded and inconclusive. A theme seen across the majority of the literature is that of referring to overseas literature, there being a paucity of reference to studies by other New Zealand researchers. This leads the authors to conclude that, though most literature is useful, an undercurrent of research for the sake of research outputs exists in New Zealand and that the lack of depth in many studies leaves us to question whether the levels of funding available for such research are sufficient.

We have seen a clear correlation between pedagogy and research paradigm; instructivist educators are more likely to produce quantitative research whereas the constructivist educator is more likely to be qualitative in their approach. Pedagogy, like research, is a continuum and this is seen in a large number of papers that triangulate quantitative and qualitative research. There is a definite pattern of qualitative research that focuses on current praxis, deducing from the researchers own experience and the environment they are in strategies to take educational technology forward. We have observed that the instructivist/ quantitative researcher operates from an epistemology of a systematic body of knowledge where rigour is critical to ensure that new information transferred to the learner is validated.

For the constructivist/ qualitative researcher, knowledge is constructed and grounded in praxis ready for the learner to comprehend within their own context and worldview and this reasoning perhaps negates the reliance on rigid definition of method and methodology at this level of research.

This grounding in praxis is also reflected in the choice of technologies being researched, new technologies such as Internet and multimedia pre-dominate and the focus on policy research is the impact that such policy has on teaching and learning, again a research focus grounded in praxis and in particular a strong correlation between government policy and funding and staff training and knowledge.

Educational technology research in New Zealand is evolving and perhaps immature (when compared to other bodies of knowledge); its constructivist heritage and tendency to follow qualitative methods leads us to conclude that this is an alive sector of research intent on bridging the theory/practice gap to offer practitioners real solutions for generating improvements in their own teaching and learning environments.

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THE ARCHITECTURAL HISTORY WEB-SOURCE: LEARNING THROUGH COMPOSITION AND ROLE-PLAY

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Abstract

The Beaux-Arts Concours is an interactive self-guided tutorial on architectural composition delivered on the web. The tutorial is based on a nineteenth century French School of Architecture. Students are required to submit an electronic design of a building using the appropriate architectural vocabulary. Upon submitting their work, students must change roles from being a nineteenth century student, to being a member of the jury. They then vote for the best submissions within their group.

Keywords

architecture, Ecole des Beaux-Arts, visual design, role-play

Introduction

The *Beaux-Arts Concours* is an interactive self-guided tutorial on architectural composition in which students are asked to compose a plan and elevation using a visual kit of parts. The tutorial is based on the nineteenth century French School of Architecture, the *Ecole des Beaux-Arts*, which used a rigid compositional method for architectural design. The work, based firmly within the Classical language of architecture, used systems of symmetry, proportion, repetition and hierarchy, as well as strong connection between plan and elevation, to build up compositions. Students of the *Ecole* regularly undertook competitions, in which they had a limited time to prepare plans and elevations. The students' competition entries would then be judged, with prizes awarded as appropriate. The teaching system was highly influential in Europe and America and was the pre-eminent method of architectural design on continental Europe for most of the nineteenth century.

The module draws on many of these principles, including the competition system. Students are required to submit an electronic design of a building (plan and elevation) using the appropriate architectural vocabulary of the *Ecole des Beaux-Arts* (which is provided in a visual kit of parts). Upon submitting their work, students must change roles from being a student of the *Ecole*, to being a member of the jury. They then vote for the most successful submission within the tutorial class (using the assessment criteria of symmetry, proportion, repetition and hierarchy). Winners are awarded *médailles* and *mentions.*

Educational Objectives

The *Beaux-Arts Concours* is one of a number of projected web-based interactive resources that aim to improve students' knowledge, comprehension and analysis of architectural history. The use of an interactive medium is designed to promote an active involvement in a non-linear approach to history. The educational approach is twofold. Firstly the students are learning the principles of *Beaux-Arts* architecture by designing (Naidu, Anderson & Riddle, 2000). Secondly the students are engaged in role play as both students and jurors from a nineteenth century school. Laurillard (1993, p. 190) points out the value of students acting out other roles in order to discover first principles for themselves. In this case the aim is that the principles of *Beaux-Arts* architecture will be reinforced through judging the work of their peers.

The Beaux-Arts Process

The *Beaux-Arts* online system is constructed to be delivered as a set of web pages on the Internet. The system includes Shockwave interactives, dynamic HTML and is supported by the Online Courseware Component Architecture (OCCA) database for storage of individual student and tutor input (Fritze, Welch & Ji, 2000). The process for delivery is as follows:

1. The composition creation and voting functions are all initially inactive.
2. On a prescribed date the subject coordinator activates composition mode.
3. Students log in to the system using an individual username and password. They follow a link directly to the *Beaux-Arts* Drawing Board and create their plan and elevation composition. The Drawing Board is a Shockwave movie linked to the OCCA database and it allows the storage of each individual student's work. The students have a period of one week to construct their composition.
4. After a week, the coordinator turns off composition mode and activates voting mode. Students view all compositions within their group and choose three or more to add to their personal shortlist.
5. Students then move on to the voting page in which they study each of the compositions they have short-listed and vote for first, second and third place. Students can add comments against each of their nominations indicating why they feel the composition is a good example.
6. The tutors view the compositions of every member of each group. The tutor disqualifies any composition that breaks the *Beaux-Arts* rules, and types in an explanation for the disqualification into a text field on the same page. The tutor can also view and censor any undesirable student comment.
7. After the voting period has past, the coordinator deactivates voting, and updates the overall vote tally for each group. The system automatically determines which members of each group have been awarded first, second and third prize. The results are then forwarded to the "Prize List" page.
8. The Coordinator then activates the "Prize List" page for all users to view. First, second and third prize-winners of each group are shown. By clicking on the name of a prize-winner, the user can view that composition.
9. Students are also able to view their own composition. They can see comments from other group members, their tutor, or the coordinator. If their composition has been disqualified, the reason for disqualification is also displayed.

Technical Features

Beaux-Arts Drawing Board

The *Beaux-Arts* Drawing Board, implemented using an interactive Shockwave program, provides the student with a visual, menu-driven environment in which to create their construction. The interactive module consists of a plan view and an elevation view of the composition, each having its own palette of images (or kit of parts) to use in the construction. The Drawing Board is versatile in that the images can be easily changed to meet other needs.

Users have a number of editing functions that allow them to create complicated compositions easily. These include: images can be dragged from the palette and dropped onto the board; images can be repositioned or removed; images can be rotated; users can flip an image piece horizontally or vertically; images can be resized; the layer position of an image can be changed using "Bring Forward" and "Send Back" commands; images can be cloned with the original properties preserved (size, location and rotation); students can load and save their work to and from the OCCA database, and clear the drawing board.

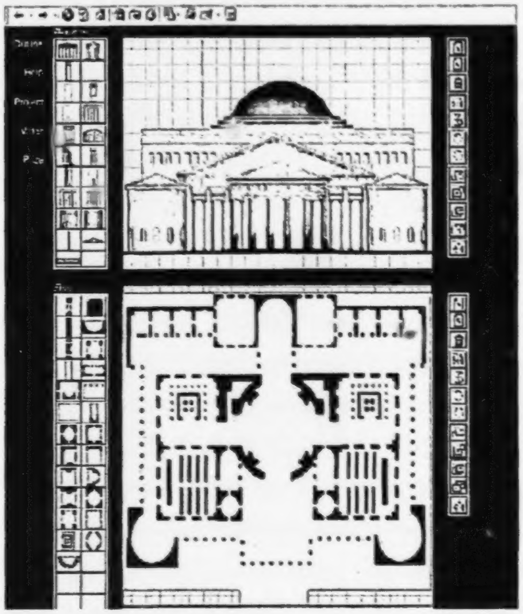

Figure 1: The Beaux-Arts Drawing Board

Flexible Delivery

The *Beaux-Arts* site is a flexible environment in that it allows users to access all its elements on and off campus. Each time the user logs on, the last saved state of the environment is loaded regardless of where the user is accessing the system.

Anonymity

The anonymity of the student creators of each of the compositions is important to prevent any personal bias from affecting the outcome of the voting process. Therefore, each user is automatically assigned an alias by which their construction can be recognised, but which provides no way for another student to determine the identity of the composer.

Short-listing and Voting

The shortlist process is one in which students in a group view their group members work and choose a selection. Because this shortlist has been saved to database, the user can log onto the system anywhere and anytime and the state of this shortlist page will be reloaded. Students then progress to a voting page to register their first, second and third choices.

Administration Functions

Built into the system are a number of administration tools designed to: batch register students from the University's main student web system to OCCA as student users; create an arbitrary number of "student" groups; assign students to groups; create a "coordinator" user, who is able to control the delivery of each component of the system; create a list of tutor users, and assign each tutor as the controller of one or more groups.

Automated Functions

The system will automatically close a user's session after around 30 minutes of network inactivity. The drawing board regularly communicates with the OCCA server in order to keep the connection alive and allow auto-saving. The tallying of votes for individuals in each group is also performed automatically by the system.

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Evaluation

Formative evaluation strategies within the project consisted of : the testing of a prototype drawing board by several postgraduate students and academic staff; a further test of the full composition and voting system with a broader selection of students and academic staff. Both tests were conducted in the Architecture Faculty computer laboratories. Each test provided valuable technical and conceptual feedback to assist in the design of the system. Summative evaluation consisted of monitoring student (and tutor) work both during and after the exercise and administering an online survey at the conclusion. A number of paper surveys, which were different to the online questionnaire, were also handed out to get more detailed feedback. Of the 67 students enrolled in the subject, 43 (or 64%) completed both the composition and voting phases. There were four groups with approximately equal numbers. Here is a selection of the findings:

1. Those students who completed the exercise generally did it very well. The level of complexity of the designs was very good. Students spent around 120 minutes on the composition and 30 minutes on voting. They returned to the exercise from two to five times. The instructions and competition rules were clear.
2. Some students had saving problems – the wording of the onscreen message needs to be clarified. Some students had difficulties in downloading the plug-ins over a modem.
3. Additional tools to assist tutors would be useful, eg. an indication of which students have saved their compositions.
4. The comments field on individual submissions was used, though not extensively.
5. One student was disqualified for not following the design rules – tutor comments were sent to this student.

Conclusions

After some initial technical problems the program was able to run within its limited window of time with a majority of students completing both phases of the exercise. Any technical difficulties were to do with downloading and installing the Shockwave plug-in from home, or rendering problems in a Netscape browser (overcome by using Internet Explorer). Some improvements to tools for tutors could be made. The educational evaluation of whether students have been able to learn the Beaux-Arts design principles is achieved through tutors visually verifying the compositions and through the responses to the surveys. The paper survey offered much more in terms of understanding of educational objectives. The results reveal that the exercise achieved its goals in terms of helping students to gain a better understanding of architectural history – some of the answers in the surveys demonstrated very good understanding of the principles and insight as a result of the jury process.

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A WOMAN'S REPRODUCTIVE LIFE CYCLE: A DEVELOPMENTAL JOURNEY

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Abstract

This paper describes the development of a computer-facilitated learning package that integrates the various stages of A Woman's Reproductive Life Cycle integrating reproductive and endocrine physiology. A holistic yet modular approach has been taken with the design of the package and the modules follow the developmental journey of a woman throughout her major reproductive life stages from birth to menopause incorporating puberty, menstrual cycles, contraception and pregnancy. The overall development approaches are described as a part of the package design. Students are presented with a single case study and follow the reproductive and endocrine changes that take place in this woman over time. A core component of the package is a graphical simulation tool, which has been developed to encourage exploration and understanding of the complex mechanisms involved in hormonal regulation of the menstrual cycle.

Keywords

multimedia design and development, educational technology development, reproductive physiology

Background

We are developing a series of computer-facilitated learning modules called *A Woman's Reproductive Life Cycle* that describe and integrate the various stages of a woman's reproductive life cycle. Experience suggested that students typically have difficulties understanding the complex nature of reproduction and endocrinology during various stages of a woman's reproductive life cycle. The menstrual cycle is central to all reproductive aspects of a woman's life and within this cycle the areas of homeostatic hormonal feedback control and regulation are traditionally difficult concepts for the students to fully grasp. A major learning obstacle for the students involves the understanding of the negative and positive feedback regulation of ovarian hormones by the hypothalamus and pituitary gland. To fully understand the menstrual cycle students are required to integrate the hormonal changes with the alterations in the development of the follicle and endometrium throughout the cycle. Another motivating factor in the module development is that an understanding of hormonal feedback regulation is central to students' understanding of many key physiological concepts and systems. Lectures describe the theoretical aspects of menstrual cycle regulation and hormonal feedback but provide little support for students as they attempt to integrate and apply their knowledge. The modules we are developing attempt to address these difficulties by providing a realistic case study that grounds the student in the real-life circumstances of a woman's developmental journey. Thus a primary goal in the development was to provide students with an environment in which they can explore the complexities of the menstrual cycle and integrate their knowledge with other stages of a woman's reproductive life.

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Design and Development Approach

The development team adopted Keppell's design and development model for interactive multimedia (Keppell, 1998). This model emphasises a team-based approach and sets out a number of stages including needs assessment, conceptual design, software development, interface design, evaluation and maintenance. In the current project the development team consisted of content experts, project manager, instructional designer, graphic designer, software developer, programmer and an evaluator. A needs assessment established that a two-hour package would be developed containing modules for each life cycle stage. During the initial design phase, the instructional designer and the content experts developed a concept map illustrating the macro-structure of the modules (online). This process was essential in establishing the overall architecture of the package. Through this process the instructional designer became familiar with the content and this knowledge was utilised in subsequent phases of design and development. Concept maps and storyboards were used both as scaffolds for planning the micro-design of each module and as tools for communication between designers, developers, programmers and content experts. Using Kennedy's formative evaluation cycle, which is critical to the design and development approach, the package has undergone iterative expert review of instructional and conceptual design and interface and graphic design (Kennedy, 1999). The first module will undergo useability testing, the results of which will be used to inform the development of subsequent modules.

Design of *A Woman's Reproductive Life Cycle*

One of the primary design approaches adopted by the development team was to construct a series of modules that would follow the developmental journey of a woman throughout her reproductive life stages from birth to menopause. These life-stages (and biological years) are: birth (0 years), puberty (~12 years), menstrual cycle (~14 years), contraception (~14+ years), exercise and menstrual cycle (~14+ years), pregnancy, infertility and menopause (~55 years). Figure 1 presents the home screen and shows each of the eight modules represented schematically as a biological clock. We were able to secure photographs from a woman illustrating her at various ages (from birth to menopause) that represent her major life-stages, reproductive milestones and experiences (Figure 1). The aim of this approach is to create a 'real-life' look and feel for each module so that students come to identify with the woman and feel they 'get to know' her. We are providing students with a realistic and developmental case study that will act as a scaffold for their inquiry into the content. Using this holistic approach, students should come to appreciate and integrate the physiological changes that occur in one individual over her life span. We hope this will lead students to integrate and compare and contrast critical reproductive concepts over the entire life cycle of a woman.

As the menstrual cycle is central to all reproductive aspects of a woman's life, our first step was to develop a graphical simulation of the normal cycle incorporating changes in hormones, feedback regulation and in ovarian follicular and endometrial structure. The simulation dynamically links the endocrine and endometrial profiles with feedback regulation during the menstrual cycle with a graphical representation of follicular development. This simulation will form the corner stone of the package, as students will subsequently be able to compare and contrast the normal menstrual cycle with abnormal situations or to different life stages. The simulation is flexible and will allow students to choose which hormonal profiles, feedback loops, follicular and endometrial structures are displayed. Students will be provided with guided questions and activities which allow them to explore, using the simulation, the normal menstrual cycle.

A "resources" catalogue will be available to students at any time throughout the package giving them the option to further explore concepts and issues based on their individual interest and needs. Formative assessment activities and exercises (such as drag and drop activities and prediction tasks) will be included at critical points in the package to allow students to test their knowledge and understanding of the material. Once students have familiarised themselves with basic science concepts associated with the normal menstrual cycle, they will be able to extend and integrate their knowledge to other stages of a woman's reproductive life cycle. This process will also involve students applying their knowledge of "normal" processes to "abnormal" processes such as lack of menstruation (amenorrhea), athletic menstrual cycle irregularity, infertility and menopause. Using their knowledge students will be asked to make predictions about the basis of endocrinological and physiological changes that are a result of these situations. Throughout, the single case study will be emphasised, showing students that these changes are a normal part of every woman's life.

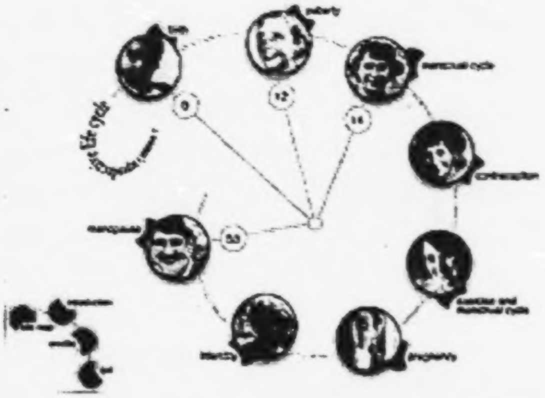

Figure 1: A Woman's Reproductive Life Cycle (online)

Integration of reproductive concepts over the life-span will be further encouraged in the contraception module. Students will be presented with background information on contraceptive techniques, including basic biomedical information, physiological methods of action and effectiveness (i.e. pregnancy rates). Students will be able to investigate the physiological effects of oral contraceptives by manipulating the components of the graphic simulation. By considering case studies at various life stages (i.e. adolescence, multiple partners, secure relationship with one partner, married no children, not intending to have children, birth spacing, family complete, perimenopausal), students will determine the most appropriate form of contraception given the characteristics of the woman at that reproductive life stage. Students will justify their choice based on physiological methods of action using their knowledge of menstrual cycles.

Educational Approaches to Design

One of the educational approaches taken to the design of this package was the use of multiple perspectives. Koschmann, Kelson, Feltovich and Barrows (1996) argue that if students are provided with a singular perspective, they may oversimplify concepts that may ultimately prove misleading. Additionally, researchers such as Ramsden (1992) and Laurillard (1993) have advocated the use of multiple perspectives to support for higher levels of cognition including reflective thinking. The use of multiple perspectives was incorporated into the package in two ways that are linked to the design approaches. First, students were asked to consider biomedical and social aspects of the reproductive cycle by identifying with a woman at different life stages. Students are challenged to consider the similarities and differences in the reproductive cycle of, for example, a menstruating teenager and a menopausal woman. Second, through the use of the graphical simulation students were asked to consider and integrate the menstrual cycle from a variety of biomedical perspectives (endocrinological, physiological and pathophysiological). Only by integrating knowledge, both across the lifespan and across different biomedical perspectives, will students come to fully appreciate the complexity of the female reproductive cycle.

A second educational approach to the design was to ask students to adopt roles when considering various aspects of a woman's reproductive health. Aspects of Joyce and Weil's (1986) role playing approach to learning have been adapted and are a unique feature and strength of this module. Joyce and Weil (1986) suggest that "the essence of role playing is the involvement of participants in a

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real problem situation and the desire for resolution and understanding that this involvement engenders" (p. 242). Within the contraception module students will be asked to play a variety of roles and make decisions about the most appropriate form of contraception at the various stages of the woman's reproductive life, firstly from the woman's perspective and then from her partners point of view. By taking this approach we hope that students will "explore their feelings and gain insights into their attitudes, values, and perceptions" (Joyce & Weil, 1986, p. 242).

The modular nature of *A Woman's Reproductive Life Cycle* allows flexibility in design and development as well as teaching and learning. The package is planned for integration in a variety of curricula at different year levels and across a number of disciplines and will compliment current teaching and learning methods. Both biomedical information and the graphical simulation can be used as a lecturing tool; introducing, exemplifying and explaining concepts. The package will also be used as a self-directed learning resource for students studying in the problem-based learning curriculum in the School of Medicine. Finally, specific modules will be used as computer-based tutorials in the Science, Optometry, Dental Science and Biomedical Science courses.

Conclusion

The team-based approach has greatly assisted with progress on the project so far. An emphasis on conceptual design and the macro structure of the package enabled the content experts and the designers to gain a clear understanding of where the project was headed before computer based design began. A prototype of the menstrual cycle module is close to completion (at the time of writing) and Version 1 of the package will be ready for be curriculum integration in 2002.

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WEB-BASED TEACHING:
THE BEGINNING OF THE END FOR UNIVERSITIES?

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Abstract

This paper describes a web-based, generic, inter-disciplinary subject called 'Computer-aided policymaking'. It has been offered at Melbourne University, Australia from the beginning of 2001. It has generated some salutary lessons in marketing and pedagogy, but overall it is concluded that web-based teaching has a rosy future. Nevertheless, difficulties in getting this particular inter-disciplinary subject widely accepted have laid bare some of the disciplinary-based myopia and information-based elitism that characterizes traditional universities. It is therefore concluded that adaptation to the web's greater flexibility and democratization of education is an urgent priority for universities if they wish to retain their present position of leadership.

Keywords

web teaching, internet, decision support, policymaking, information, elitism, university, education

Motivation for the Subject

One way to get students' attention is to ask them why they are attending university. They will stare at the floor and shuffle their feet while their instructor muses over whether they are studying to make money, demonstrate their intellectual superiority, meet a lifetime partner, avoid full-time work or simply indulge their curiosity. In truth, students attend universities for some, if not all of these reasons. But what is the "official" story? Why does the public continue to subsidize higher education?

For vocational faculties the answer is easy - to ensure that society will have graduates capable of building things, healing the sick, ensuring that justice is done and so on. For the non-vocational faculties, like Arts and Science, the usual justification is different. It goes along the lines that society needs graduates who are capable of wrestling with complex ideas, who understand histories, who are sensitive to different cultures and who are creative, articulate and critical to boot. But why does society need such graduates? It could be that generalist graduates foster an orderly and democratic society. But other personal traits besides educational enlightenment are needed if we are to sustain a just, fair and ordered civilization - qualities like personal health, empathy, awareness and morality. But the public purse does not pay for our personal trainers, social interactions, holidays, mobility or spiritual well-being. However, it does pay for people's higher education. Why?

Perhaps there is some kind of societal expectation that graduates of generalist faculties will be able to tell everyone how to do things better. That is, they will be able to make decisions about the future that are better than the decisions that we have made in the past. Their greater wisdom and understanding will ensure that they lead the great debates of our time and so steer us towards better decision making. In short, they will be good policymakers. But it does not always work this way. Indeed, most readers will have met generalist graduates who are able to give many different reasons why any proposed policy is inadvisable. Yet they are insufficiently in control of themselves to be able to recommend what exactly ought to be done. In short, they are poor policymakers; academia has performed less than optimally when it comes to producing good decision takers.

The reason for this might be related to universities' obsession with information. Many academics have a touchingly innocent belief that if enough information is collected then someone in authority, some bureaucrat, politician or director, will simply base decisions on their information and so policymaking will be improved. This is naïve. Decision takers usually have far more things to think about than just the empirical, logical or analytical justification for scientists' or other advisors' favorite policies. Nevertheless, the academy keeps concentrating, almost exclusively, on theorizing, gathering information and analyzing, as well as producing students who are able to do these things well.

Such stubbornness stems from a prevailing mindset that is reminiscent of Edward de Bono, who once said that if we knew everything, then what to do would simply be obvious. But we will never know everything. Indeed, it was once pointed out that by the late 1960s we knew enough to enable humankind to walk on the moon. Yet if there had have been people living on the moon at the time this task would have been immeasurably more difficult. There would have been so much haggling about where the astronauts should land, who would meet them, which guests would be permitted to attend their welcome reception and where the visitors would stay, that the whole Apollo mission might have had to have been aborted. When people are involved, choosing the most suitable policy becomes much more difficult no matter how well "supported" some particular one might be.

Therefore, to balance the academy's obsession with decision support and to emphasize the people part of the people-oriented policymaking process, a web-based subject, *Computer-aided policymaking*, was launched at Melbourne University. It deals with the policymaking lessons that can be derived from policymaking software - software that is designed to help people actually make a decision about what is the best thing to do. Such decision-making is assumed to occur after all the information has been collected and all the decision support reports have been read and assimilated. That is, the subject focuses on "point of decision" processes; those that take place, with people in mind, at the crunch time when it is necessary to recommend a course of action to a minister, company board or whomever.

Chronology

The subject's genesis was predictable enough. With higher education's decreasing resources and increasing staff work loads, in 1997 the author's department resolved to slash lecture-preparation time by consigning teaching materials to the web. Better still, if cooperative partnerships with leading academics around the world could be formed to do this, our subjects might attain genuine global leadership and so enable us to survive within the brave new world of web-based and ultra-competitive education. Yet such enthusiasm did not last for more than a year or so. Although much teaching material was duly placed onto a local server for our own students, *Computer-aided policymaking* was the only subject to make it into the international arena. It is the only one to be completely web-based in the sense of having no face-to-face contact at all between lecturers and students (Relan & Gillani, 1997), and it is the only one that is consciously offered to people who are not enrolled at our home university.

The subject's emergence was helped by the author writing its basic textbook, also called *Computer-aided policymaking*, at about the same time (Wyatt, 1999). Moreover, in 1998 the author applied for, and was awarded study leave, which he used in part to visit US and UK. Here he personally enlisted the support of two American and the one British software writers, all of whom he had met previously but who had never met each other. These three individuals are all full professors who spend most of their research time developing and promoting their software. Thus in every case their software is based on many years of consulting experience around the world. All of these professors readily agreed to contribute their software and thoughts to this web-based subject, perhaps partly because of the publicity that this subject might bring for their respective computer packages.

Subject Content

Of the ten "lectures", each of four software writers, from US, UK and Australia, contributed two, with the coordinator and author of this paper, the Australian, also writing introductory and concluding lectures. Such lectures are parked on the subject's web site and students are sent, by ordinary mail, a password to access them. Each teacher's first lecture is about how to use their software, and their second is about how their software has been applied to a wide range of real-world, policymaking problems.

There are four assignments that are respectively based on each of the four, highlighted software packages. Trial versions of the latter are supplied on a CD-ROM that is posted out to each student. The only other item of assessment is a 3000-word essay, submitted by email. In it, students address issues raised by the textbook, the lectures, the assignments and any additional reading. When writing up their essay, candidates are supposed to discuss whether or not the various prescriptions for better policy-making, presented in the textbook, lectures and assignments, have been confirmed or confounded.

All students enrolling in the subject are made members of the class' email discussion list, and an automatic welcome message is sent to their email address whenever this is done. It is explained that all comments on, and problems with the subject are to be sent to the discussion list so that everyone in the class sees them. In this way it is hoped that students will help each other to solve their mutual problems in the true spirit of cooperative learning (Ellis and Fouts, 1993). It is also insisted, in lecture one, that every new class member makes a "maiden speech" to the rest of the group before they are posted the CD-ROM of software. Such a maiden speech should outline what other subjects the candidate is studying and why they want to undertake this particular one.

The subject's web site, as well as students' welcoming letters, state that all candidates must finish the subject within a minimum of six weeks and a maximum of 13 weeks. It is also explained that the subject is equivalent to a standard 12.5 point subject within the University of Melbourne's Arts faculty. As such, it constitutes a quarter of a full time student's load at any one time, and so it requires up to 10 hours of work per week over a twelve-week "semester". In terms of fees payable, any student at Melbourne University, where it is an approved subject, pay to do it like they would pay to do any other subject. For those enrolling from elsewhere, the flat fee is $(US)300, and if a whole class from an external institution enrolls, discounts apply.

Pedagogical Lessons

The strengths of the subject are fairly obvious. Not only is it far cheaper for any department to teach than would be the equivalent campus-based subject, but it also enables students to be taught by an international consortium of experts who, by definition, would not be able to teach a campus-based subject together. Moreover, the around the clock discussion group can, in theory, achieve levels of student involvement that are unattainable by campus-based subjects. Also, the lectures can be continually changed if they are wrong or unclear to students, again, something that cannot be done when they are delivered in the conventional way. Another advantage of web-based subjects is their flexibility. Students can fit in their work around their increasingly complicated lifestyles as they juggle their time between study, recreation and paid employment for financing their university fees. Finally, students save considerable time by not having to attend lectures and conventional tutorials. This mode of teaching seems designed to conform to the way people live, work and play (Monteiro, 1998)

However, the news is not all good, because with this particular subject some unanticipated things happened. For instance, despite widespread enthusiasm for making "maiden speeches", one mature, female student sent a private email to the instructor saying that she would do no such thing. The author replied within a day or two, explaining how the discussion list only existed, for the good of all, because her fellow class members were willing to contribute to it. This prompted a reply from her explaining that she disliked "public speaking", especially to a discussion list whose membership might well be huge and which might even include people she knows – which would make her change what she wanted to broadcast. So, just in case other students had similar reservations, the author sent a class list to the discussion list, but before he did this, the student concerned sent in her maiden speech to the group. It was the longest ever received, and it went into some detail about the policymaking methodology aspects of her job, a job that involved taking abuse from all sides of environmental debates, because she worked as a telephone assistant for a state minister of conservation. Whether this student genuinely was frightened to "talk to" an unknown group, or whether her job made her wary of making "public" utterances, or whether she simply did not like doing things until she was well prepared, must remain open questions. Indeed, they could be fruitful lines of research for others studying web-based education.

Only a disappointingly small amount of discussion ever took place on the discussion list. Despite several initial declarations of enthusiasm for "working together in the weeks to come", few bothered. At times issues were raised, but once the instructor answered them, such discussions went no further. There could, of course, be many reasons for this. Perhaps the instructor did not answer questions in a way that encouraged further discussion from the class, although he certainly tried to. Perhaps there was interaction between various, or even all members of the class outside the official discussion list. Alternatively, perhaps students at Melbourne University are simply too competitive, or too shy, to actually share insights. All of these are plausible reasons for the lack of activity on the list.

The most likely reason, however, was that most class members were simply embarrassed because they were procrastinating. Virtually everyone was "behind schedule" in the sense that well into the semester the instructor had not received even one small assignment from anyone. Even at the end of the subject, only one student had submitted all four assignments and the essay. Moreover, of the original 18 local students enrolled during semester 1, 2001, only 12 stayed in the subject until the end. We can therefore remark that, at least as far as this subject was concerned, for web-based students the temptation to leave all their work as late as possible becomes too much. One student even procrastinated to the point of not collecting a CD-ROM containing the assignments' software until the twelfth week of the 12-week semester. Since it can be quite embarrassing to admit that one is behind, it is little wonder that discussion on the email discussion list, about problems with assignments and so forth, was sparse. Whenever they encountered difficulties, many students simply sent personal email messages to the coordinator instead.

The Underlying Problem

Behind these lessons lurk several deficiencies of modern universities in terms of their ability to adapt to the burgeoning growth of web-based teaching. At least in the western world, universities are under-resourced, they are defensive about their current position within the educational pantheon, they indulge in disciplinary chauvinism and their teaching staff have, in a way, been spoilt by their privileged position hitherto. We will deal with each of these problems in turn.

Universities Lack Resources

Shrinking funding can be endured for a while. Teaching staff simply work harder by taking larger classes and doing more administration. Eventually however, they start complaining about lack of time to do research and so maintain the quality of their teaching. So more administrators are employed to take some of the burden. But administrative staff are sometimes intent on making their own jobs secure and they therefore make more work, for themselves and for others, so that they themselves look indispensable. The result is that administration loads become heavier rather than lighter, and the whole administrative function of the university becomes slow and unresponsive to change.

In our particular case, *Computer-aided policymaking* took a full two years to make it through all of the approval committees, and so it did not have a viable class size until 2001. Such tardiness surprised the author, given that web-based subjects were hardly a new phenomenon elsewhere. After all, by 2000 there were over 800 US colleges and universities offering distance courses for credit, to their own and to other students, mostly via the web (Simonson *et al.*, 2000). It is true that at the unofficial level there was encouragement for the author. All academic staff at Melbourne are sufficiently trusted to allow them to offer subjects as a "not for credit" course on the web. But it was a different story when seeking approval to make this an official subject that is worthy of entry into the university handbook. Committees seemed forever to be placing obstacles in its path.

Without being privy to what was said at the latter's various meetings, one can only surmise, from hints and suggestions that have been put to the author, about what the major stumbling block was. It seems to have been authentication. If students were to be unseen, how would the instructor know that it was they who were doing the work for the assignments and essay? Accordingly, approval was granted only after the author convinced the committee that procedures had been put in place to guard against such cheating. Specifically, all externally enrolling students have to sign a form consenting that they can be quizzed by telephone about their knowledge of the lectures, textbook and software. Moreover, after such a quizzing, the subject coordinator is within his or her rights to insist that they post, by ordinary mail, a statutory declaration signed by someone in authority in their local neighborhood, saying that it was they who had been speaking on the telephone. This is why there is an email discussion list and the "maiden speech". Apart from stimulating helpful discussion and feelings of belonging, such speeches serve to make each participant's writing (and speaking) style well known. Hence it is easier to spot any suspicious changes in style when the final essay is submitted.

In short, Melbourne University is ambivalent towards Internet-based education. It does not want to miss out on any advantages that it may have, but the university still takes a long time to approve any instance of it - in this case, due to concerns about authenticity of students work. Thus a prestigious, traditional, university wants to sell itself as a boutique, campus-based institution rather than a huge open-learning body for the masses. But it also wants to be at the cutting edge of education by being on the faster and flexible web. These two aims are contradictory and so pursuing both tends to make them detract from each other's chances of success. Moreover, if money is to be in even shorter supply in the future, the inability of traditional universities to keep up with developments in web education is likely to be exacerbated further.

Universities are Competitive

Many staff fall into the trap of boosterism. We certainly did. We thought that our university is of world importance, or at least of sufficient importance to make prospective students enroll because of its good name. But this simply did not happen, despite our being very careful to choose appropriate key words for our subject's web site, our submission of key words to several web search engines and considerable advertising to targeted academics at various business schools within North America.

The reason probably has a lot to do with the fact that prospective class members around the world would probably be studying at some tertiary institution already, and the latter is usually not likely to approve their students enrolling in some web-based subject as a component of their degree. This is partly because of their staff's uncertainty about the quality of any outside subject and partly because academic staff tend to think that they teach all the necessary subjects satisfactorily themselves. Why, therefore, should they "import" subjects from the web?

Put differently, importing subjects from elsewhere is tantamount to admitting that one's own institution is incapable of teaching such material by itself. This will never be conceded because every educational institution has its own vested interests at heart, and it needs to protect the job security of its existing staff. True, one day it might become obvious to deans that importing web-based subjects is far cheaper than teaching in house. But a subject's quality would have to be extremely well thought of, or the home institution would have to be in very deep trouble, before departments would be willing to lose so much control over their courses.

Nevertheless, the author thought he might be able to ensure that this subject was taken by a whole classes at a Dutch university. This was because he had a contact there who admired the subject. Accordingly, he broached the topic when he was visiting in 2000. But alas, *Computer-aided policymaking* was not exactly what they wanted for their students. They might well be able to use its content as part of an existing, in-house subject, but not as a substitute for it. They were more interested in GIS-based information analysis for policymaking support, rather than exclusively in software for making final policy decisions. Every academic has a slightly different view of what subjects ought to include. So it is difficult to get them to acknowledge merit in someone else's choice of content.

The teachers who would be most likely to go as deeply into policymaking software as our subject does are, in fact, the other international collaborators. One works in a business school, another in a government policymaking school and the other in a development studies department. But even these professors have failed to recommend the subject for their own students. No doubt they all teach subjects in which their particular software, and its associated approach to policymaking, takes pride of place. So why would they want to substitute for their own subject one in which their software receives only a quarter of the attention at the most?

It should be noted that a casualty of all this can be staff actually shielding their students from exposure to web-based teaching excellence. In order to be "the best of its kind in the world", our subject necessarily became very specialized in its focus. This was the only way to keep it manageable enough to be able to mount it on the web anyway. Such specialization brings excellence, but it also triggers a host of barriers to its acceptance. These include marginalisation by many professions, chauvinistic rejection by others and within still others an unwillingness to substitute one subject for the eclectic fragments of knowledge that they currently teach. Readers who plan to offer a specialized web-based subject, one that will supposedly survive because of its excellence, need to be prepared for this.

Disciplinary Chauvinism

Computer-aided policymaking has potential to be very popular. The author has so far asked only three faculties to list the subject – Arts, Architecture and Engineering, and they have all said yes. Moreover, it should be of interest to many other faculties as well, because policymaking occurs within all vocational disciplines. But such a genuinely inter-disciplinary nature means, somewhat perversely, that it finds it hard to locate a secure "home of its own". The result is that, so far, it has attracted few students.

It did not even make the handbook in Engineering in 2000 and it had such minor prominence in Architecture's offerings that just one student from that faculty enrolled. The largest numbers came from an Arts Faculty department where it was actually registered and promoted a little more. But alas, changes in that department prompted its head, midway through 2001, to threaten to remove *Computer-aided policymaking* from his list because the department only wanted subjects it "could control". This person now shows signs of keeping *Computer-aided policymaking* because of its quality and relevance to his students, but its survival there continues to be somewhat precarious.

Our point is that unless the teacher is actually part of the staff of a department, where they can look after their subject in terms of making sure that it remains on lists and is not displaced by another subject, then its survival will always be problematic. Academic fence building, despite the rhetoric that we often hear about encouragement of inter-disciplinary content, has resulted in rather paranoid, chauvinistic and in-bred departments. Consequently, any subject like this one, which claims to be genuinely inter-disciplinary, will find it hard to be "taken in" and protected by any one department.

The author actually works in a humanities department, whose members are not really interested in policymaking. So he did not even try to get this subject approved within his own unit. It was approved, through an associate in another department as one of their own subjects. However, once it became evident that it was earning student resources from enrolments, its subject number was changed so that payments would flow to the author's department. This in turn may have prompted some of the approving department's displeasure with the subject - again, the author is not privy to discussions that have taken place.

Note also that the author's position in a humanities department has probably been a disadvantage in terms of wider acceptance. Places like business schools possibly see the subject as too non-rigorous and analytically undemanding for their students. This is unfortunate since, with the demise of much public policymaking due to government downsizing and outsourcing, one of the strongest remaining bastions of policymaking techniques is, in fact, business schools. Accordingly, they can be expected to contain many potential students. But disciplinary chauvinism of the type that sees other disciplines as inferior, and therefore incapable of teaching their own students anything new, has reacted against the prospects of this subject.

In theory, this subject should have been most welcomed by a former department in which the author worked - Urban Planning. But although the latter department listed the subject, it has not been actively encouraged there. This is because of changes within the urban planning discipline that make computer-aided policymaking (planning) highly unfashionable. Indeed, anything that smacks of computer-based analysis has been out of favor for at least 15 years. Its academic leaders (but not its genuine practitioners) find it more meaningful to emphasize phenomenology, pragmatism, structuralism and deconstruction theory in the tradition of grand design theory (Parkin, 1993).

Finally, even amongst the professional planners and policymakers that the author and colleagues have encountered while consulting, several resent having to "talk to a computer". As such, they are automatically against the whole spirit of computer-aided policymaking (Wyatt & Smith, 2001). They feel that policymaking is a warm, organic, human, ambiguous, iterative and gloriously illogical activity. Applying cold, silicon-based, inhuman, precise, sequential and logical computers to it, therefore, seems inappropriate. It follows that there are several students out there, particularly in Arts faculties but also in Architecture and even in Engineering, who are simply ideologically opposed to taking this subject due to the growth of "anti-science" during the late twentieth century.

Custody of Information

Due to lack of resources again, university libraries are rapidly canceling their subscriptions to many refereed journals. The result is that one cannot now attend the library of a large university and expect, as during the last several centuries, to find the latest knowledge there. Such knowledge has been privatised. It is increasingly available in the form of electronic journals and databases that are accessible only to paying subscribers. Hence unlike during the middle ages and even after the invention of the printing press, universities no longer stand as the sole repository of frontier knowledge. The new guardians are the owners of the servers on which electronic publications are stored. Universities, and their staff might still subscribe to the important electronic databases and journals, but rising prices will eventually see universities' grip on them loosen.

This has implications in terms of how academics see themselves. They have long been used to acting as the gate keepers of cutting edge information. After all, great prestige is attached to such a role. If one is in control of a field's information then one will often be asked to give advice on practical questions whose proper solution seems to depend on information. But if one no longer is a custodian over such information, one becomes less useful to policymakers. Consequently, academics are making strenuous efforts to maintain their position as information-based gurus.

Accordingly, they keep insisting that information is the key to good policy advice. As such, they find it hard to believe that some people, like the teachers of *Computer-aided policymaking*, do not see policymaking as predominantly an information-dependent activity. It relies just as much on tracking the hopes, fears, beliefs and desires of the common people who are going to be affected. To most academics this viewpoint seems like heresy. Since the ancient Greeks, custodians of learning have tended to divide knowledge, and their own individual roles, into substantive fields - geology deals with rocks, chemistry with chemicals and so on. This is why generic, technique-based disciplines such as mathematics, computing and policymaking have frequently found it difficult to be accepted.

Hence, on the one hand, academics believe that universities will keep their prestigious position as advisers to society so long as all problems are seen as solvable by collecting information about all the substantive fields that impinge on the particular problem. On the other, if problems are better solvable through more democratic, less elitist techniques rather than information-collection, then expansion of web-based, interactive policymaking techniques will torpedo the prestige of information-controlling, academic experts. Fear of the latter seems to be a major reason why the inter-disciplinary subject, *Computer-aided policymaking*, tends to be rejected by established academic departments.

Conclusions

Our conclusions follow naturally. Lecturers should make sure that the subject approval process is sped up, perhaps by incorporating some form of web-based examination procedures (Brooks, 1997) in order to placate those worried by authentication of students' work, and perhaps having someone with power to shepherd your subject through the various committees. Also, if your subject is genuinely inter-disciplinary you might find it difficult to find a supportive department to nurture and protect it. In addition, one needs to consider carefully how specialized the content is to be. If it is highly specialized like ours is, even with a four-person internationally cooperative effort it is not guaranteed to be taken by students in various countries around the world. Most teachers in such institutions will see it as too narrowly focussed to devote a whole subject towards its content. On the other hand, if you make your subject a generalized one that includes diverse things, the competition from local institutions' own subjects is likely to be fierce, and so again, few teachers from elsewhere will recommend it for their students. One needs to think carefully about the ideal balance between specialization and generality before finalizing one's offering.

Also, since an obvious problem with our subject, so far, has been its students' procrastination, one remedy is to insist that certain deadlines will be met, with say, the first two assignments not being accepted after week four, and so on. However, there could also be more subtle changes that would inspire the students to first become more involved and then, once involved, to submit more of their work on time. For example, although simply having an email discussion group is a first step that prompts students to make introductory speeches that promise an exciting amount of "self-regulated" learning (Pintrich, 1995; Romiszowski, 1997) ahead, such a forum probably needs to be made even friendlier and more welcoming. It could be useful, for instance, to reveal periodically who else is studying the subject and to make their photographs available for viewing. This would give the discussion list a genuine "human" feel about it (Porter, 1997). Failing that, part of the subject's assessment could be tied to the students' amount of participation in the discussion forum.

Finally, the mounting of our subject on the web has indicated that there are serious flaws in universities' current efforts to maintain their control of education. Universities are elite and exclusionary, not to mention possessive of and addicted to information. By contrast, the web is democratic, inclusive and much more sharing of its resources. Financial pressures on modern universities have made many of them turn inwards to defend their ancient stance rather than outwards to embrace a more flexible, more transparent world.

It took our experience with *Computer-aided policymaking*, a subject whose thinking is more Internet-oriented than traditional and information-based, to highlight such contrasts in educational approach. The clever universities will adapt to web-driven changes in the manner recommended by social constructionist theorists (Bijker & Law, 1992) but others will not. Melbourne University has show a willingness to adapt to changes in the face of considerable opposition from traditionalists, so at least its intentions are forward-looking. But unless a majority of universities do likewise, it is possible that the sector as a whole will eventually lose the privileged position that it has enjoyed for the last thousand years.

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A WEB TOOL (✓TICTT) TO SUPPORT REASONING IN THE HEALTH PROFESSIONS

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Abstract

This tool is designed to help prepare graduates to use theoretical knowledge to become independent critical thinkers ready for the workforce and career and life changes.

Keywords

clinical reasoning, critical thinking, cognitive tools, Internet, health sciences

Introduction

Medicine and nursing are highly complex professions operating within a rapidly changing health care environment. Teaching physicians and nurses to think analytically and reflectively and use knowledge and skills to provide safe and effective care is essential to the future of both professions. Considerable research has been undertaken to elucidate the skills that underpin clinical reasoning in nursing and medicine since they are critical to professional practice. Since many medical graduates, Australian and international, show one or more deficiencies in their capacity for clinical reasoning (Neame, 1984), developing the capacity for clinical reasoning in medical and nursing curricula is of great importance. This paper describes the development of ✓TICTT (The Critical Thinking Tool), an Internet tool to aid development of students' clinical reasoning skills in case-based or problem-based curricula.

One well-recognised method of inducting novices into a community of expert practitioners is apprenticeship (Rogoff, 1984). *Cognitive* apprenticeship specifically involves the induction of novices into expert ways of knowing, thinking and reasoning (Brown, Collins & Duguid, 1989). The characteristics of an ideal learning environment to support cognitive apprenticeship were elaborated by Collins, Brown and Newman (1989). In essence, knowledge and cognitive skills are learned through observation, coaching, practice and feedback in real life contexts. After observing an expert execute an activity (modelling), the learner tries the task with expert guidance (coaching). Whilst coaching, the expert provides reminders and feedback (scaffolding), which are gradually removed (fading) as the task is performed independently and with increasing proficiency. Coaching includes careful sequencing of instruction from simple to complex, increasing the variety of examples and practice contexts, and proceeding from global to specific skills. Novices are encouraged to think about their actions and justify their decisions (articulation), analyse their own performance (reflection), and try out different strategies and observe their effects (exploration). Exposure of novices to complexity, multiple ways of accomplishing a task, and interaction with experts and peers, the varying degrees of skill help learners to recognise that there is no one embodiment of expertise and encourages them to view learning as a continuing process (Vygotsky, 1978) embedded in a social milieu.

The conceptualisation of clinical reasoning in medicine is based upon three elements: a well developed discipline specific knowledge base from which further context-specific knowledge can be derived, higher order cognitive skills (analysis, synthesis etc) and metacognitive skills. Since there is no set of generic reasoning skills that can be used to correctly resolve all clinical problems (Norman & Schmidt, 1992), varied and flexible teaching approaches are necessary to develop graduates' clinical reasoning skills. Recent curriculum innovations in medicine and nursing have moved toward teaching and facilitating clinical reasoning rather than focusing on specific content and solving specific problems (Elstein, Shulman & Sprafka, 1984). Problem-based learning (PBL) curricula aim to facilitate the development of an appropriate knowledge base for clinical practice and to foster explicitly hypothetico-deductive and clinical reasoning strategies and reflective practice (Barrows, 1988).

Problem-based learning curricula are based upon the cognitive apprenticeship model and the premise that knowledge and cognitive skills are best learned when embedded in the social and physical contexts in which they must be used (Brown, Collins & Duguid, 1989; Norman & Schmidt, 1992). It draws on all characteristics of the ideal learning environment. In medical PBL curricula, students participate with physicians in a community of learning and practice to develop the explicit knowledge, reasoning processes and skills required of competent physicians. Learning is centred on authentic problems or patient cases and facilitated by a clinician who models, coaches and scaffolds the process. Interaction with peers provides opportunities for consideration of different perspectives and elaboration and articulation of knowledge in a collaborative and supportive environment (Barrows, 1988). Through learning with medical professionals and contact with patients, students also become aware of the metacognitive skills and collective behaviour, values and communication systems that operate within the profession.

Cognitive Apprenticeship & Design of ✓TICTT

✓TICTT provides opportunities for learners to develop the cognitive processes of experts within the constraints of the technology. ✓TICTT is designed for use in a variety of macro teaching and learning contexts (lectures, for collaborative small-group tutorials or self-directed, independent study), and the degree to which the various elements of the ideal environment for cognitive apprenticeship (Collins, Brown & Newman, 1989) are present in a curriculum, depends to a great extent on the author/teacher. The relationship between ✓TICTT and these elements is described.

Content ✓TICTT itself is a shell in which the author presents case scenarios, expert opinions and in which peer opinions accumulate with program usage. Content-specific resources can be hyper-linked or added to the shell to serve as an aide memoir for student learning. Problem-solving strategies used by experts, shortcuts and tips of the trade are often embedded in the reasoning and commentary of experts. Through combination with other teaching strategies, the metacognitive capacities of experts can also be uncovered for learners.

Methods It is intended that the first case/scenario is the author's opportunity to model the cognitive processes of experts; comparative feedback provided from expert and peer opinion develops user's analytical skills and serves as both coaching and scaffolding for learner users as they understand the elements drawn upon for expert practice. Learners develop their ability to clearly articulate their thoughts and reasoning through practice and observation and discussion and feedback through a discussion forum. Reflection is promoted in ✓TICTT through a number of strategies: opportunities for learners to revise and edit answers to questions, the ability to write personal comments in a cumulative note-book; and explicit questioning by the author. Finally, the discussion forum and opportunities within the program to "pause" and research issues or use their own metacognitive processes before continuing with the program facilitates reflection, perhaps the most powerful tool in the expert's repertoire of practice (Schon, 1984).

Exploration involves placing students into a new problem-solving situation where they play the role of expert (Collins, Brown & Newman, 1989). In the challenge section of ✓TICTT students meet new scenarios based upon their initial model case/scenario, thereby enabling them to apply their knowledge and reasoning skills to broader topics.

Sequence The ✓TICTT case builder encourages authors to build cases that include a narrative that leads users through the case scenario in a logical and sequenced manner. Cases in ✓TICTT are intended to build from prototype scenarios to more complex variations on the same theme, or along combined themes arising from earlier modules. Use of a structured sequence of questions modelling simple reasoning (e.g. hypothetico-deductive reasoning), scaffolds students' own reasoning capacity before they embark on increasingly diverse and complex scenarios. This staging enables the learner user to build the various skills, language and knowledge base underlying expert practice.

Sociology This tool enables novices to "sit-in" on the thinking and reasoning processes of an expert. The tool is designed for use in a lecture situation, by a small learning group in a tutorial or by individuals in a self-directed manner. Thus the collaborative element is largely determined by the environment created by the teacher. The linkage of a discussion forum raises opportunities for unstructured collaboration amongst peers and discussion with experts.

Overview of the Tool (✓TICTT)

✓TICTT is tool useful for case-based teaching. It is a framework in which an author presents case scenarios, expert opinions and in which peer opinions accumulate with program usage. The program content is mainly generated by users; it changes and grows as users access and engage with the materials. Data accumulates within the shell and with time a resource is developed that may be edited, re-visited by course participants and analysed for purposes of educational research.

Design and Development The design of ✓TICTT was initially conceptualised for use in PBL curricula to acknowledge the unique contribution workplace practitioners can make to students' learning and thus assist students to develop the skills to think like experienced practitioners and facilitate graduate transition to the workplace. The core design of ✓TICTT was based on an assessment tool developed for a PBL medical curriculum (Zimitat & Alexander, 1997).

User Requirements The two user populations considered in the design were academic staff responsible for the construction of cases, and students, the ultimate users of ✓TICTT. Academic staff required a flexible system that can be structured for and used in a variety of teaching and learning settings depending on the number and nature of students in their course and the level of the course. A case-building interface enabling upload of multiple file types was required for use by academic staff with a range of IT skills. Finally, the whole student-work database needed to be available for down load and analysis. From the perspective of students, ✓TICTT should also be able to access and run ✓TICTT from any computer on- or off-campus. Students and staff need to use ✓TICTT on Windows-based university staff computers and computer laboratories. It was a secondary requirement that ✓TICTT operate across platforms and across browsers.

Features of the Tool

✓TICTT enables authors to create a course consisting of several modules. Each module consists of several sequentially encountered sections: a model case, resources, a reflective pause, up to three challenge cases, debriefing element and discussion forum (Figure 1). The model case section allows the author to present, sequentially, a case scenario supported by multimedia elements (sound, images, video) and interspersed with questions. Learner users are requested to enter responses. They then have the opportunity to examine expert and peer responses to that question before revising their answer and continuing. The author can hyperlink to external web resources (e.g. textbook), software or course material to assist students. There are opportunities for learners to review the case elements, see their original and improved answers and write personal notes. The reflective pause enables the author to focus the learner on one particular aspect of the case, their learning or past experience before they continue with the challenge cases. It can also be used as a natural break-point for students to identify learning issues for further study before continuing. The challenge section is intended to aid the transfer of cognitive skills to scenarios beyond the initial case encountered in the module. This section allows the author to present similar cases, or increasingly complex cases that draw upon learning and skills in previous modules. The case author might choose to use the discussion form to facilitate interaction among peers or with experts to facilitate learning in this section or in the debriefing section where learner users have the opportunity to reflect on the module, their learning and the commentary of experts.

Finally, an Intelligent Case Editor facilitates construction of the modules and analysis of the underlying cumulative database of student navigation and peer responses. The author can determine: the length of cases; the questions asked; the number of resources made available; whether certain sections in cases are omitted; how, where and if the use of the discussion forum is used and the nature of other teaching and learning activities associated with the tool.

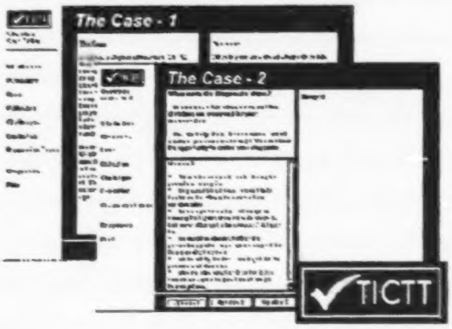

Figure 1: A screen shot illustrating elements of the tool and the prototype interface

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